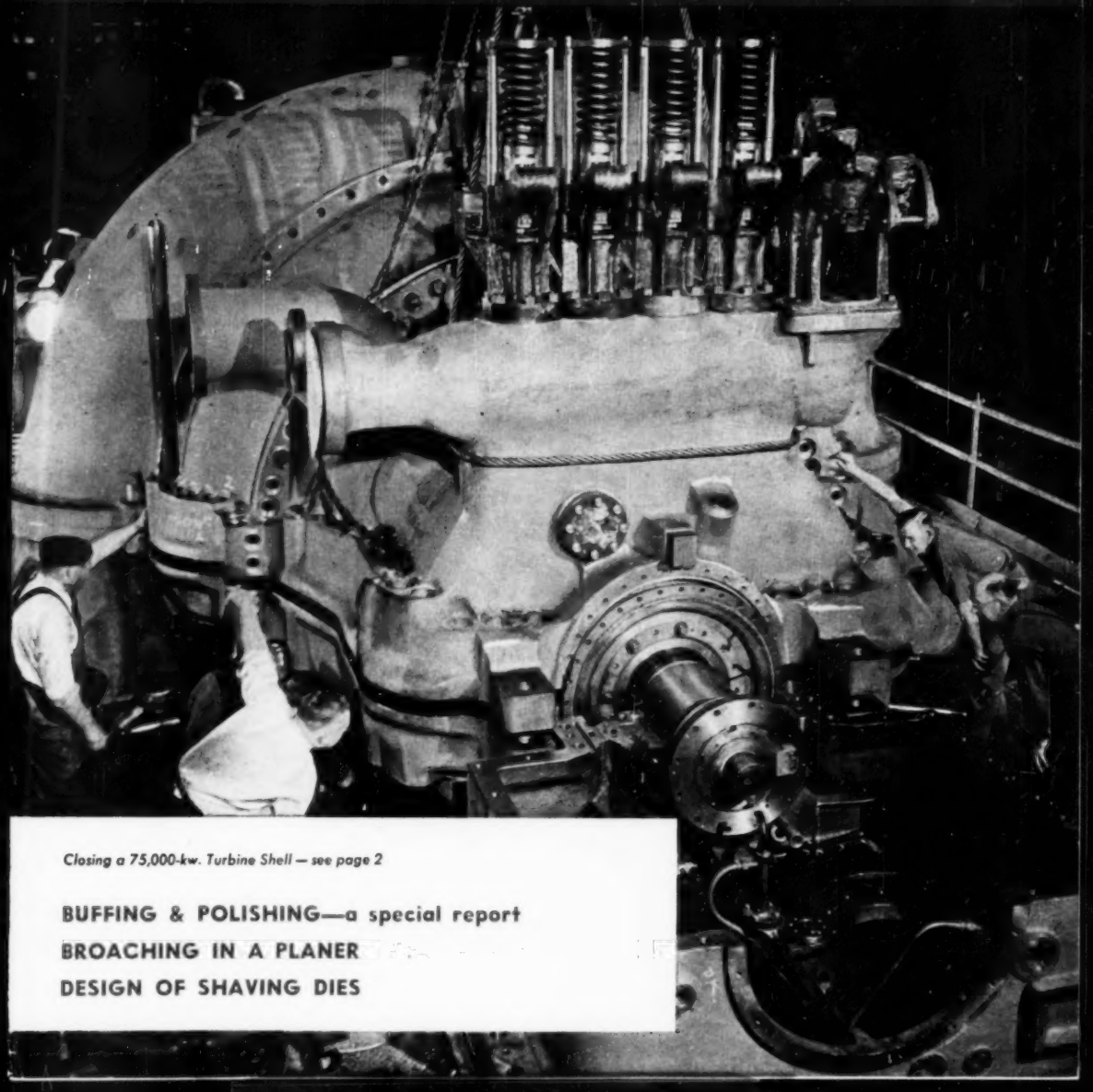
AUGUST 11, 1949

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

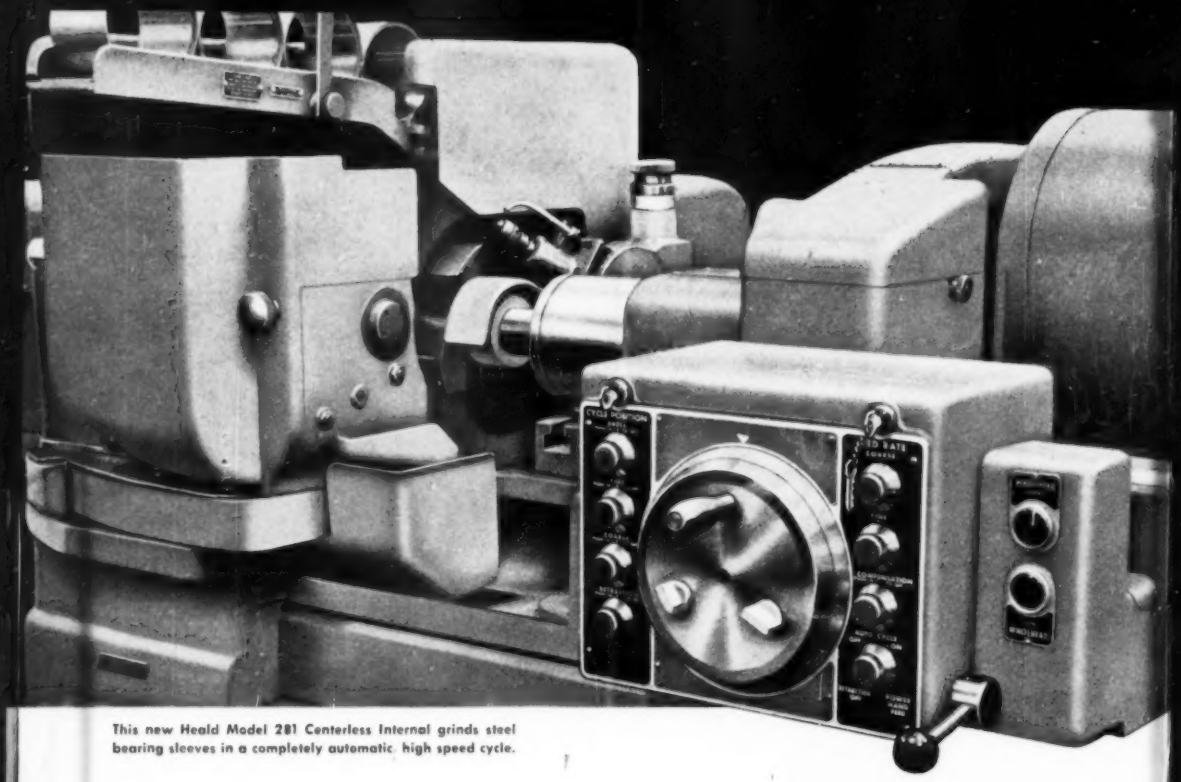


Closing a 75,000-kw. Turbine Shell — see page 2

BUFFING & POLISHING—a special report

BROACHING IN A PLANER

DESIGN OF SHAVING DIES



This new Heald Model 281 Centerless Internal grinds steel bearing sleeves in a completely automatic, high speed cycle.

COMPLETELY AUTOMATIC CYCLE SPEEDS OUTPUT 50%

New Heald Model 281 Centerless boosts bearing sleeve production, with perfect concentricity and better finish

More and more manufacturers are finding that completely automatic machine cycles are the answer to more profitable production. Here's a typical example.

The Heald Model 281 Centerless shown above grinds steel sleeves 1½ times faster than by previous methods, which required individual loading and clamping of each part. Now all the operator has to do is keep the loading chute filled and remove the finished parts from the unloading chute. What's more, the centerless principle assures perfect concentricity, for each part is rotated and ground by location on its own outside diameter. The sleeves are ground in two separate operations — first, a semi-finish grinding which removes .028" of stock — and second, a finishing operation which grinds off .013" of stock, to .001" size tolerance and a 10 microinch finish.

If you produce parts that can be rotated on their own O.D., completely automatic centerless grinding can make a big difference in your production costs. Your nearest Heald representative will be glad to show you how a new Heald Centerless can do the job faster, easier, and at much lower cost per part.

THE HEALD MACHINE COMPANY
Worcester 6, Mass.
Branch Offices in Chicago • Cleveland • Dayton • Detroit
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HEALD

PRECISION INTERNAL AND SURFACE GRINDERS

PRECISION BORE-MATIC FINISHING MACHINES

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Our Cover . . . Erectors position the upper half of a turbine shell for a 75,000-kw GE steam turbine to make our cover Kodachrome. Jim Burns took the shot during filming of the Turbine Division's "Power By Which We Live."

Mirror Finish . . . Many metal products have increased salability because of their finish—that means buffing and polishing. So we've asked Jerome L. Bleiweis, metal-finishing consultant, to put down in black and white the fundamentals of the job. They make up our current 8-page Special Report.

Cartoons . . . How do you like cartoons? We've uncovered several sources of appropriate ones, so we've been using 'em as space permitted. Now we have a cartoon feature — four cartoons that American Type Founders used to show employees their part in successful selling. You can use them too.

Crossbreeds . . . A technical magazine can content itself with reporting the jobs already in production and easily fill its pages. Or it can dig and sweat to try to forecast what is coming, so its readers will have a continuous look ahead. We try the second alternative, in this issue with a description of the crossbreed machine tools that Arthur Merry is developing to solve jet-turbine machining problems. They're not in production now, but the prospects of their success look good; and they offer a solution to other men with soft metals to machine to high accuracy.

Mechanized Finishing . . . Materials handling is the answer to the search for economy in many cases. Our current proof for that assertion is the description of the setup for cleaning and flow-coating tractor track assemblies at Allis-Chalmers. Here's a heavy and ungainly job to handle. Mechanized handling does it neatly and with dispatch.

Shorts . . . More and more Americans are taking to shorts to solve hot-weather dressing problems. In sympathy with the trend, we provide shorts too, one on filing tricks, another on seam-welding a long narrow cylinder. Then, slightly longer, are explanations of liquid-nitrogen assembly of three pump elements at Tuthill Pump and of bench-lathe setups at Sangamo Electric for producing miniature meter parts. Like a lady's dress, they are supposed to be "long enough to cover the subject and short enough to be interesting." Which, incidentally, is a good general rule, particularly in hot weather.

Tool Men Note . . . In addition to our continuing series on portable tools and our regular "Practical Ideas," the current issue includes three tooling stories, one on cutting tools, one on test jigs and one on shaving dies. Thomas Badger of Westinghouse explains how speed and feed affect the life of cast tools. Clarence Dunlop, works manager at Burroughs Adding Machine, describes his company's inexpensive gaging fixtures. Guided plug gages and indicating pointers make inspection of small parts to close limits an easy and sure job. Then J. R. Paquin goes on with his die series to tell what to watch for in designing shaving tools.

Coming . . . *A.M.* for Aug. 25 will include a description of the SKF plan for developing supervisory teamwork, and articles on shear dies, drilling tiny holes, plant layout, and automatic machines. Our cover will show a tremendous boring mill—so big a fluorescent lighting system is on the crossrail.

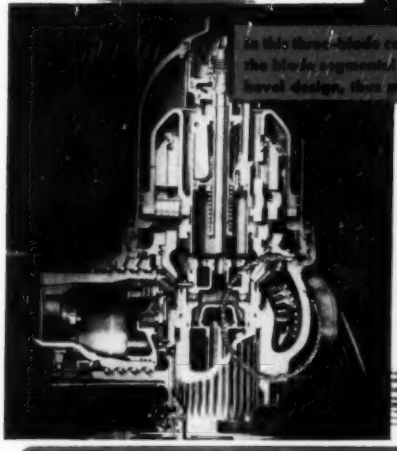
JOHN A. REDMOND,
design engineer in the Industrial Electronics section, joined Westinghouse in 1936 in the Test Dept., Radio Div. Transferred to communications engineering in 1941, his major wartime assignment was development of an aircraft transmitter-receiver and instruction of Navy personnel. Since 1944 he has been assigned to the rf heating lab, where he has applied induction and dielectric heating to industrial products, and developed work-handling equipment (See Special Report, *A.M.*, July 28).

THOMAS BADGER,
manufacturing engineer in the HQ Mfg. Lab. at East Pittsburgh, joined Westinghouse in 1940, late the next year was transferred to South Phila. to handle carbide tooling on heavy ship-propulsion equipment. From 1943-46 he was in the Naval Reserve as tool consultant, process engineer and shop supt. of a diesel repair ship. He has been on research and development of cutting tools since his return, reports latest results in this issue.

ACCURATE DURABLE GROUND CURVED TOOTH GEARS

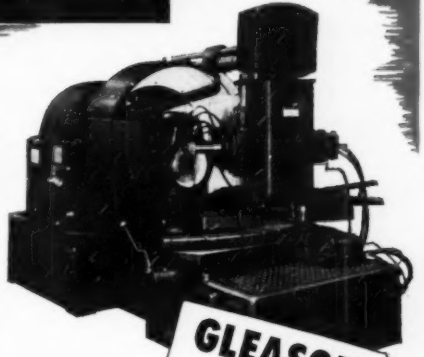
for AIRCRAFT

In present day aircraft, the demand for bevel gears to meet special requirements has greatly increased. In power operated control drives for retractable landing gear, bomb bay doors, rudders, ailerons, variable pitch propellors, aircraft engines and transmissions and rotors for helicopters; Zerol bevel and spiral bevel gears, ground on a Gleason Spiral Bevel and Hypoid Grinder, have proven through actual service that the smooth fillet radius obtained permits longer operation under heavier loads. Increased accuracy, made possible through grinding, to remove hardening distortion has permitted operation at speeds greater than previously considered practicable.



In this three-blade constant-speed propeller, the teeth of the blade segmental gears and retaining cam are of ZEROL bevel design, thus providing smooth, accurate operation.

In the helicopter field ground spiral bevel gears are used in 90° and 45° tail rotor drives and in the transmission between the motor and the elevating rotor. These ground gears are depended upon for both speed and power and greatly contribute to the successful specialized service helicopters perform for aviation.



Grinding gears on the Gleason No. 27 Hypoid Grinder assures:

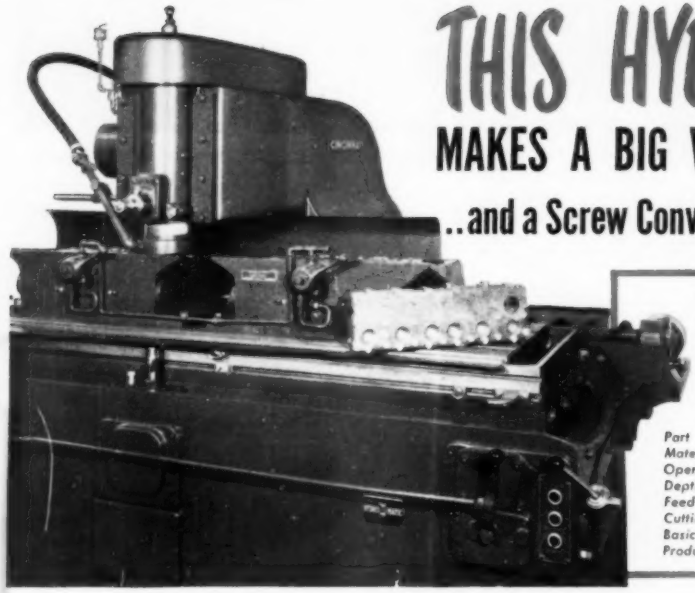
1. Highest precision and true interchangeability at mass production rates. Gears will be uniform for tooth size, tooth bearing and surface finish for the automatic cycle eliminates the variable human element.
2. An elimination of major causes of spoilage, operator's errors and omissions.

   With automatic cycle control, the operator cannot fail to follow the prescribed grinding sequence for every gear.
3. Ease of operation to simplify grinding of gears at production rates. Once machine is set up, operator has only to change work and push the start button.

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years

THIS HYDROMATIC
MAKES A BIG VOLUME OF CHIPS
..and a Screw Conveyor Takes Them Away



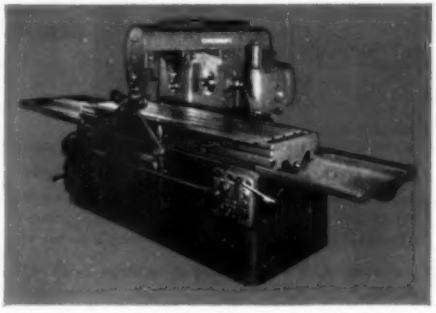
Left: CINCINNATI Hydromatic Milling Machine equipped with vertical retractable spindle, two air operated fixtures, and screw conveyor chip disposal for a high speed carbide milling operation. One of the parts is in the foreground, on the machine table.

Part name	Cylinder head
Material	Aluminum
Operation	Mill bosses
Depth of cut	3/16"
Feed	60" per minute
Cutting speed	2500 feet per minute
Basic machine	No. 56-72 Plain Hydromatic
Production	76 per hour

A big volume of chips implies high speed and feed rates, and stamina to withstand continuous operation. The CINCINNATI Hydromatic Miller illustrated here has all these qualifications, plus an automatic chip conveyor which solves the problem of getting rid of the chips without stopping production. ¶As you might suspect, Cincinnati Application Engineers had a hand in developing this equipment. Starting with a standard No. 56-72 Hydromatic bed-table unit, they added a special headstock and vertical head having retractable spindle, two air operated fixtures, and a power screw conveyor chip removal unit.

Hydromatic's two-way feed lays the ground work for the twin fixture technique — loading and unloading one while the part in the other is being milled. The retractable spindle feature saves the surface finish. The chip conveyor relieves the operator of an unpleasant job.

Equipment of this type can reduce costs in many shops . . . perhaps yours. Our Application Engineers will help you decide.



CINCINNATI Plain Hydromatic Milling Machine. Write for catalog M-1372-1 containing complete details and specifications.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

It's No Trick to Centerless Grind WAFER-THIN DISCS and RINGS on CINCINNATI FILMATICS

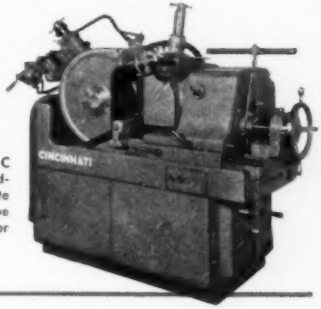
Poker chips are one of the many types of wafer-thin parts ground on CINCINNATI FILMATIC No. 2 Centerless Grinders. Production several hundred per hour.

Grinding antifriction bearing rings on a CINCINNATI FILMATIC No. 2 Centerless Grinder having increased capacity and equipped with a pusher type loading fixture.

Part name	Bearing ring
Material	Chrome tungsten alloy steel
Operation	Grind diameter (three passes)
Production	700 per hour per pass

Of course, one must *know how* to centerless grind wafer-thin parts. Knowing how is the business of Cincinnati Grinder Application Engineers. You can depend upon this group of young men with old-timer experience in solving tough precision grinding problems, to recommend the right machine, method, and tooling. ¶The method of centerless grinding work of the type illustrated here follows a general pattern—a stack of parts is picked up in a pistol grip loading device and placed in the grinding throat. They are ground by the infeed method, or by the thrufeed method, pushing the stack of work between the wheels by hand. ¶Perhaps many of the precision ground parts in your shop could be finished better and at a lower cost with the latest tooling on a new CINCINNATI FILMATIC Centerless. Our Application Engineers are at your service.

FILMATIC



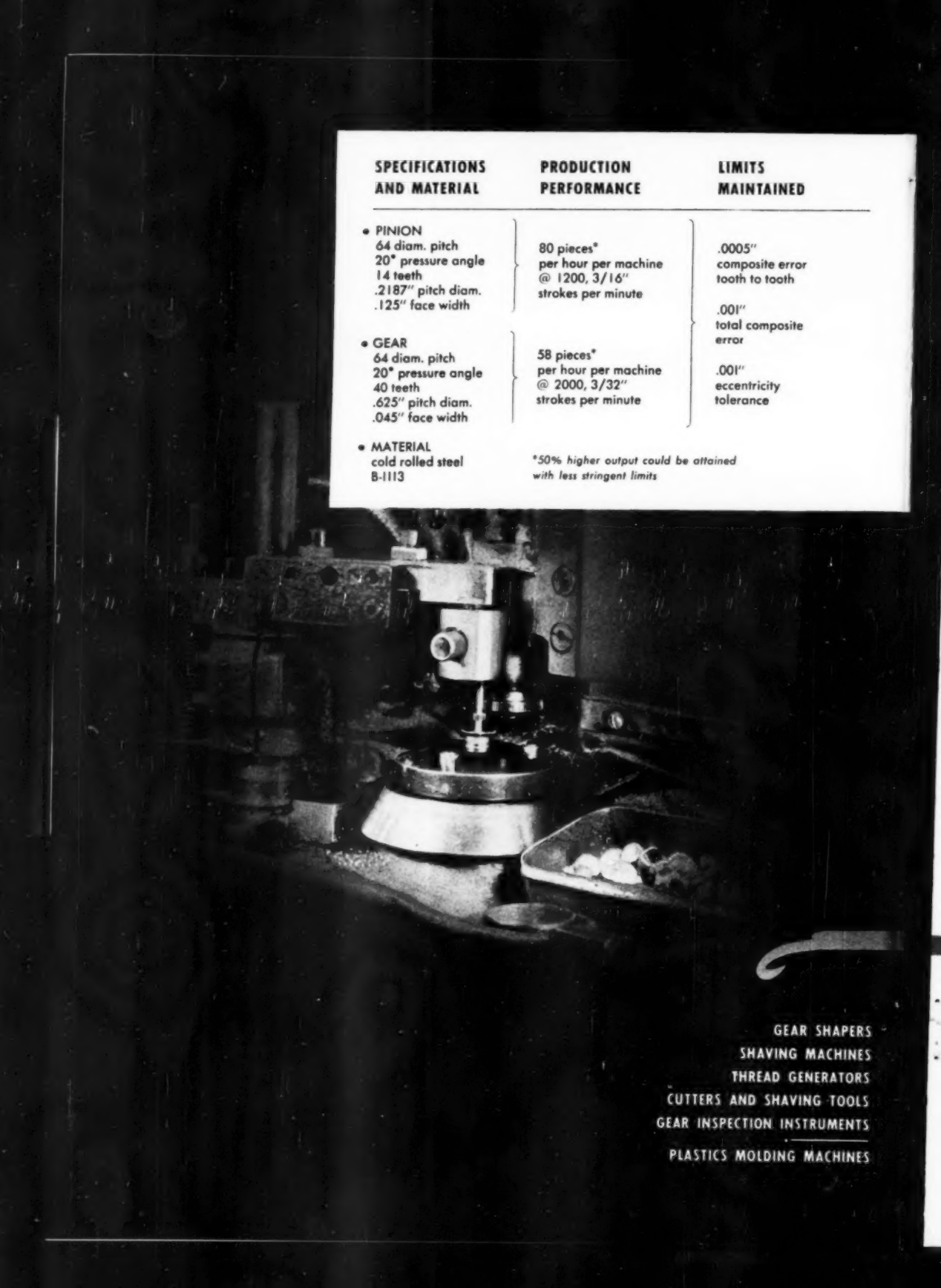
CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Complete specifications may be obtained by writing for catalog G-574.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

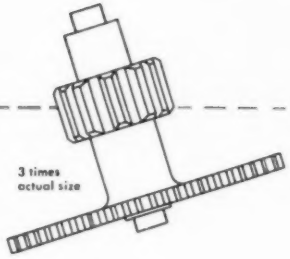


SPECIFICATIONS AND MATERIAL	PRODUCTION PERFORMANCE	LIMITS MAINTAINED
• PINION 64 diam. pitch 20° pressure angle 14 teeth .2187" pitch diam. .125" face width	80 pieces* per hour per machine @ 1200, 3/16" strokes per minute	.0005" composite error tooth to tooth
		.001" total composite error
• GEAR 64 diam. pitch 20° pressure angle 40 teeth .625" pitch diam. .045" face width	58 pieces* per hour per machine @ 2000, 3/32" strokes per minute	.001" eccentricity tolerance
• MATERIAL cold rolled steel B-1113	*50% higher output could be attained with less stringent limits	

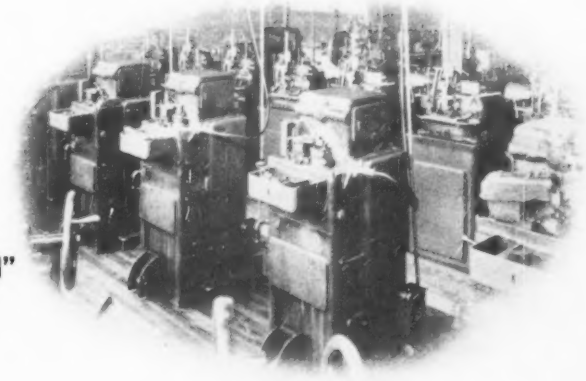
GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

64-PITCH GEAR TEETH



to .0005" Limits at Low Cost



Production on a battery of Fellows 3-inch Fine-Pitch Gear Shapers held to "cruising speed" to maintain finest quality at all times

Instrument Gear Works in Chicago is a specialist in high quality instrument Gears. They have good reason to be proud of the customers they serve and the efficiency with which the required fine-pitch gear precision is maintained. The tabulation on the facing page is a typical performance.

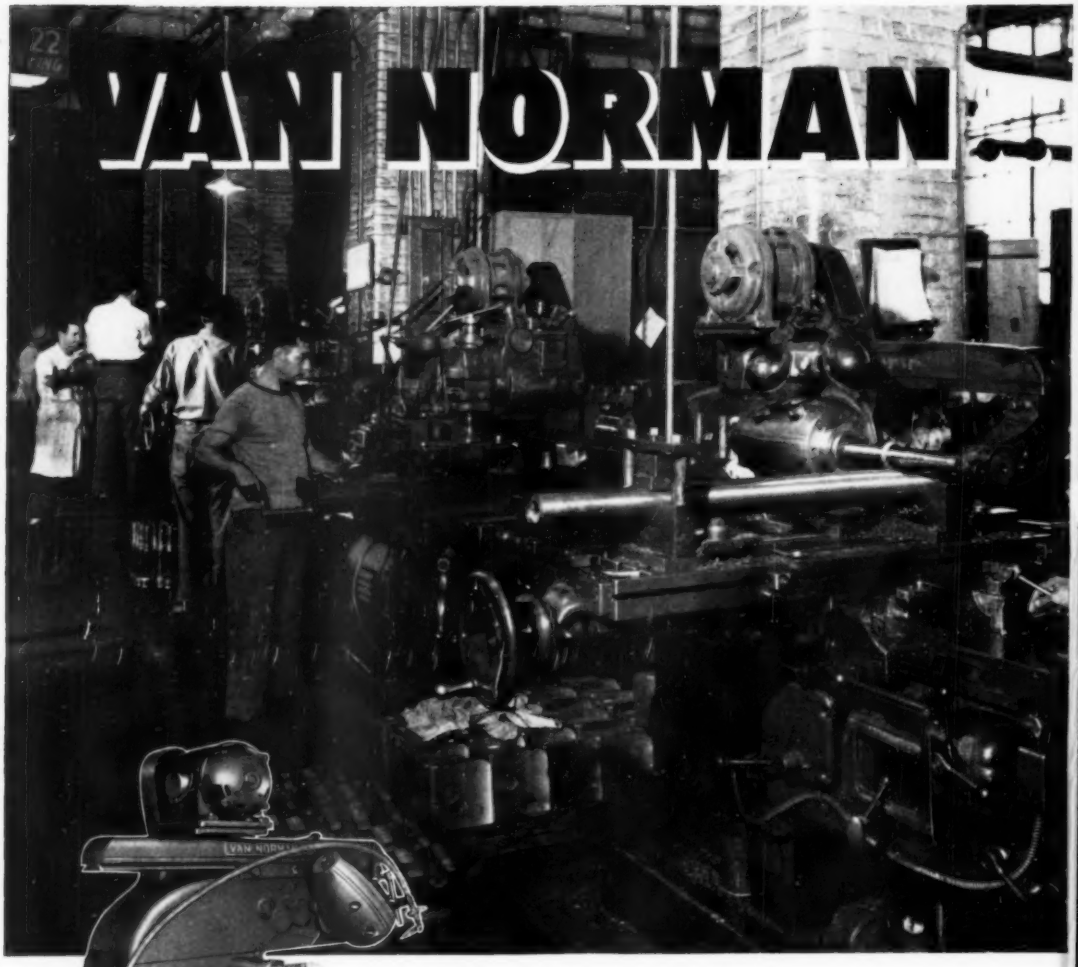
The background of accuracy control at Instrument Gear Works is reliance on a group of Fellows Fine-Pitch Gear Shapers tooled with 64-pitch Original Fellows Cutters.

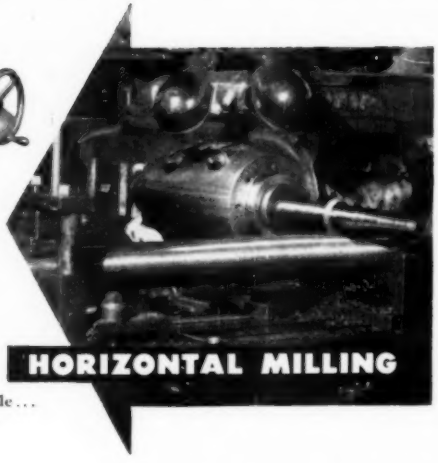
If you have a fine pitch or small gear job you owe yourself a thorough investigation of what can be obtained in both speed and accuracy from this Fellows 3-inch machine. We'll be glad to tell you where there are machines at work in your territory. Write the office nearest you.

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont.
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 7706 Empire State Bldg., New York 1.

VAN NORMAN





No. 26
Table: 58" x 13"
Over 16 other models available . . .
A size for every application.

HORIZONTAL MILLING

Ram Type Millers

Increase Milling Capacity

Adjustable Cutterhead Permits One Machine to do the Work of Three

Conventional horizontal, vertical or angular milling . . . all with one machine . . . that's what you get with a Van Norman Ram Type Miller.

All you need do is position the adjustable cutterhead in the desired cutting position and you are ready for the cut. In addition to its versatility, the ram type miller reduces work set-up time to a minimum because many jobs can be carried through to completion without re-setting up of the work piece.

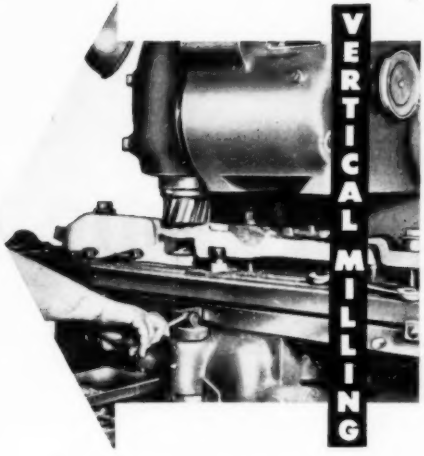
Van Norman Ram Type Millers are easy to operate. Front and rear controls permit operation from either location. Hardened and ground steel fixed cutterhead stops permit true settings at horizontal or vertical position. The rugged construction throughout assures accuracy and long operating life.

Investigate Van Norman Ram Type Milling Machines for toolroom, laboratory, pattern and die work and production milling. It will cut costs, increase production. Write for catalog.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"



Versatility

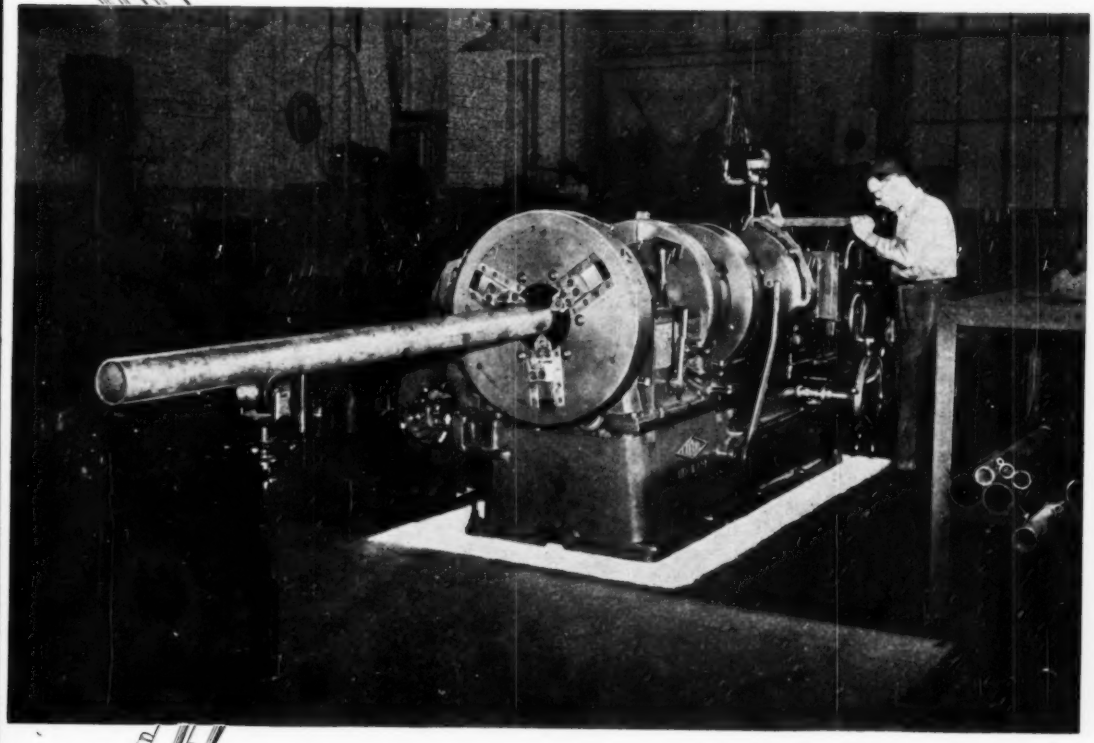
Photographs show a Landis Pipe Threading Machine installation in a Job Shop of the New York Central Railroad. This shop, located at Weehawken, New Jersey, operates as a Marine Repair Shop handling maintenance for tugs, barges, lighters, etc. Illustrations show wrought iron pipe being cut off after reaming and threading. Standard pipe threads are cut 1½" long on the 1" pipe, using a cutting speed of 25 surface feet per minute. This machine is also used for cutting boiler tubes to length.

The wide diametrical range of the die heads and the use of patented tangential pipe chasers gives these machines a versatility invaluable in maintenance work. For example, the 6" Landis Pipe Threading Machine illustrated will thread all pipe sizes from 1" to 6", inclusive. Adjustment of the die head from one size to another is simple and quick. Chasers need not be changed except for threads of a different pitch, form, or taper. Chasers are interchangeable and need only be replaced singly as needed. Tangential cutting action reduces wear, and chasers can be reground to use over 80% of their length. Thus, these machines feature—wide capacity; minimum set-up; longer running time; low tool cost; replacement; and inventory—important cost saving features for maintenance shops. For specifications and further information, write for Bulletin C-61.

LANDIS

WORLD'S LARGEST

SAVES TIME AND MONEY IN MAINTENANCE SHOPS



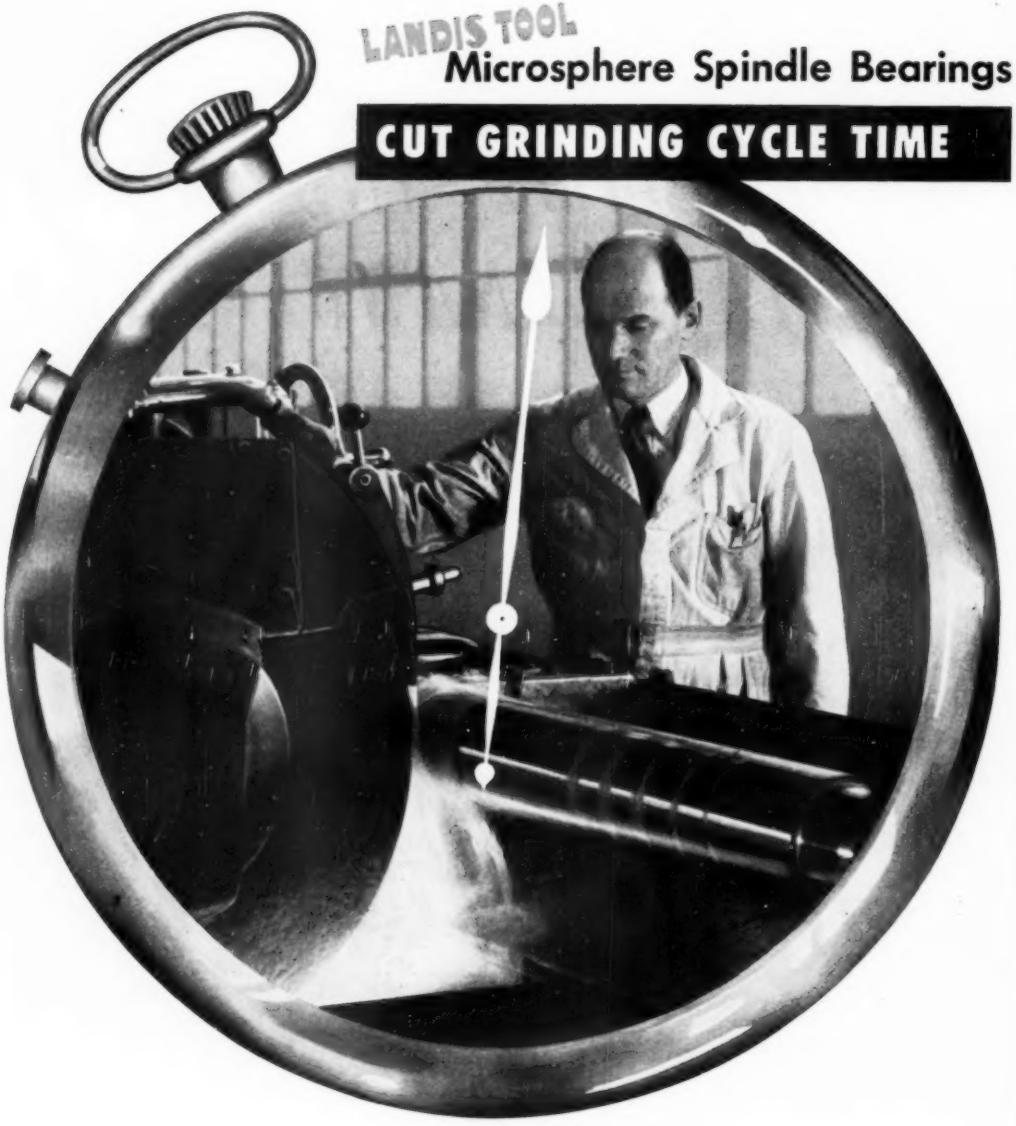
Machine COMPANY WAYNESBORO PENNA., U.S.A.

EXCLUSIVE MANUFACTURERS OF THREAD GENERATING EQUIPMENT

LANDIS TOOL

Microsphere Spindle Bearings

CUT GRINDING CYCLE TIME



LANDIS TOOL

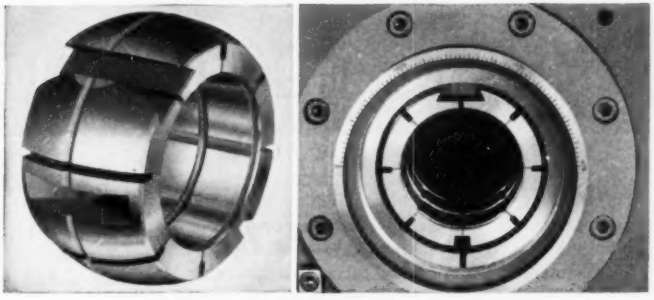
Precision Grinders

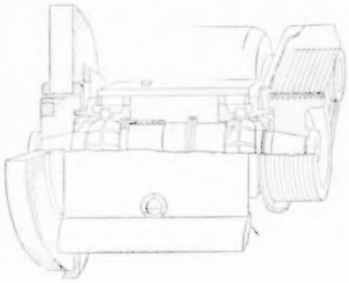
EQUIPPED WITH MICROSPHERE BEARINGS

For complete information on the features and specifications of LANDIS TOOL Precision Grinders refer to our section in Sweet's Catalog File or write for our new condensed catalog.

and INCREASE PRODUCTION

Grinding cycle time is influenced to a large extent by the sparkout period after wheel feed ceases. LANDIS TOOL has cut grinding cycle time materially by holding to a minimum the two most important factors that affect sparkout.





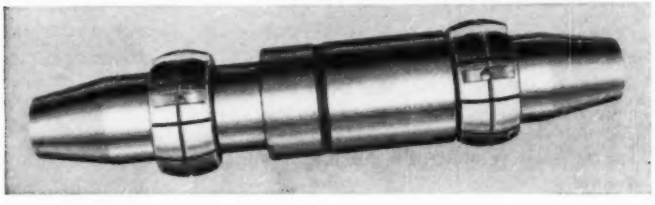
CLOSE SPINDLE BEARING CLEARANCE
with adjustable MICROSPHERE BEARINGS

Construction features of the one-piece bearing permit concentric adjustment for clearances.

When changing bearing clearance, widespread graduations give a visual indication of the change in "tenths" on bearing diameter.

GREATER STIFFNESS OF WHEEL SPINDLE
minimizes deflection while grinding

Spindle diameter is increased between bearings. This gives greater stiffness and less deflection than a single diameter spindle.



features of LANDIS TOOL Hydraulic Universal Grinders

1. MICROSPHERE WHEEL SPINDLE BEARINGS
2. EYE LEVEL WHEEL FEED
3. HYDRAULIC OPERATION
4. VARIABLE SPEED HEADSTOCK
5. RAPID HYDRAULIC WHEEL POSITIONING
6. SWINGING INTERNAL FIXTURE

LESS "pickup" LESS "splatter"

Use G-E slope control for resistance welders

Tip "pickup" in spot-welding aluminum and expulsion in projection welding is reduced with this new Slope Control developed at General Electric. It is a method of applying current in gradually increasing intensity that results in longer operation of electrodes without the frequent cleaning usually required.

Here, again, is evidence of the research continually conducted at General Electric to improve welding methods—to make the production of improved products easier and less expensive. Here are the answers to the questions we knew you'd ask about Slope Control.

Q. What is Slope Control?

A. It is supplementary equipment used with a standard synchronous or non-synchronous precision control panel that regulates the rate at which current rises to welding value, and is adjustable in terms of cycles to reach final current.

Q. What effect does this have on the finished weld, and is it slower?

A. Our tests have shown that there is less tendency for porosity, which means stronger welds, and that it does not appreciably slow the work. See the cross sections of welds made with Slope Control.

Q. Can I use it on my present G-E electronically controlled welder?

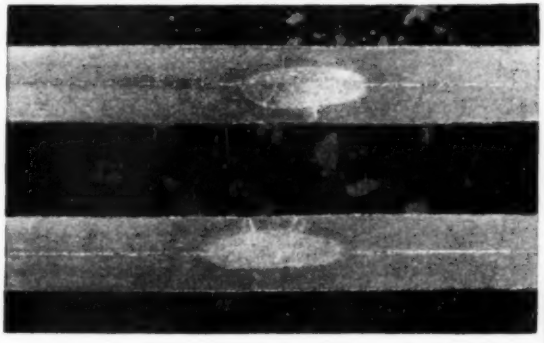
A. Yes. It is a separate panel that can be easily added to most modern G-E controls.

Q. With what types of welders and metals can it be used?

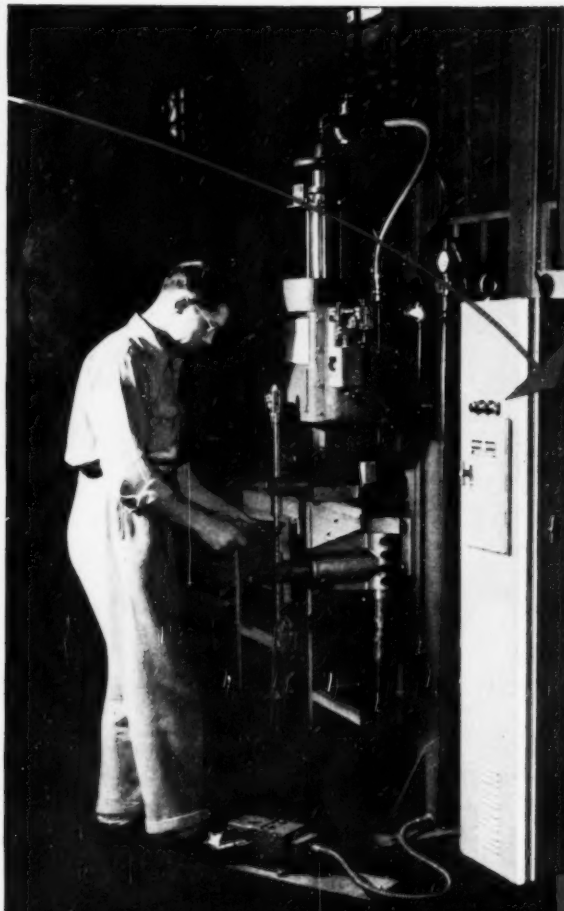
A. Use it for spot-welding aluminum (see the illustration), for projection welding aluminum or steel (it reduces expulsion), and for multiple projection welding, where you'll find improved results on non-uniform projections. It may be used with almost any metal, but aluminum and its alloys present a tough problem it can solve.

More details on G-E slope control in Bulletin GEC-534. Fill in and send in the coupon now. And when you have control problems for resistance welders, consult the nearest G-E sales engineer. He'll give you an unbiased answer based upon years of G-E experience with all types of welding. Whether it's a power factor problem, or the selection of the most suitable control for a specific job, you can be sure of your facts when they come from General Electric. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Cross sections of aluminum spot welds produced with slope control (a microphotograph).

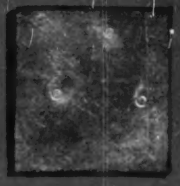


GENERAL ELECTRIC



Projection welding with synchronous precision control. Slope control is mounted in side door of unit (small door open). Can also be used with standard 60-cycle spot welders having non-synchronous welding control.

Whether you're welding aluminum or heavy gage steel ...THIS IS FOR YOU



Splatter reduced. Compare surfaces of these aluminum plates. Above, welds produced with single impulses, synchronous precision electric controls. That on left, with the addition of slope control.

ASK TO SEE "This is Resistance Welding," General Electric's More Power to America, four-color, sound motion picture covering every phase of this manufacturing process. Contains tips for improved production for operators of machines, design engineers, and supervisors. Contact your Resistance Welder manufacturer, Power Supplier, or the nearest G-E office.

Tip pick-up reduced. Electrode on left has been used 117 times with slope control. That at right used 41 times without slope control. Note wide area of aluminum pick-up.

General Electric Co., Sec. B645-50
Schenectady 5, N. Y.

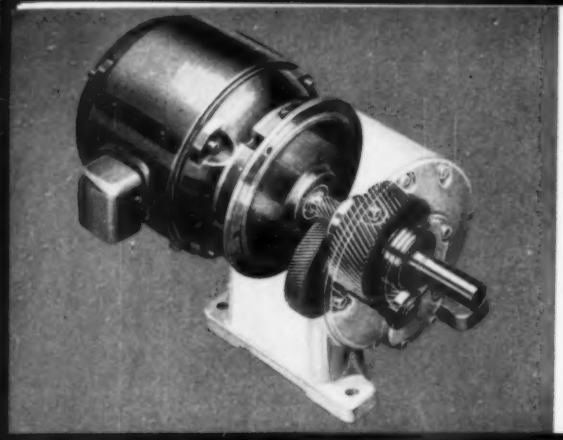
Please send me Bulletin GEC-534 on Slope Control.

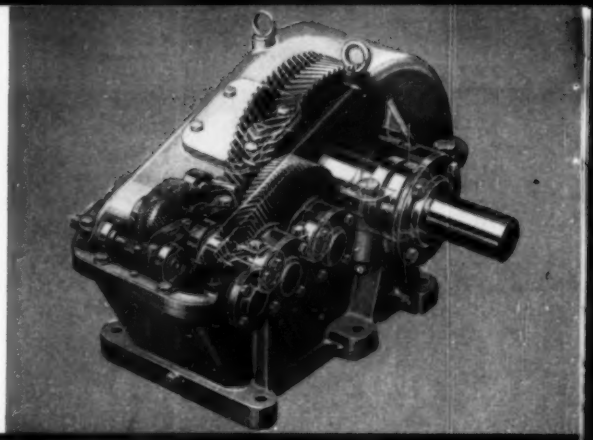
.....I would like a showing of "This is Resistance Welding."

NAME .....

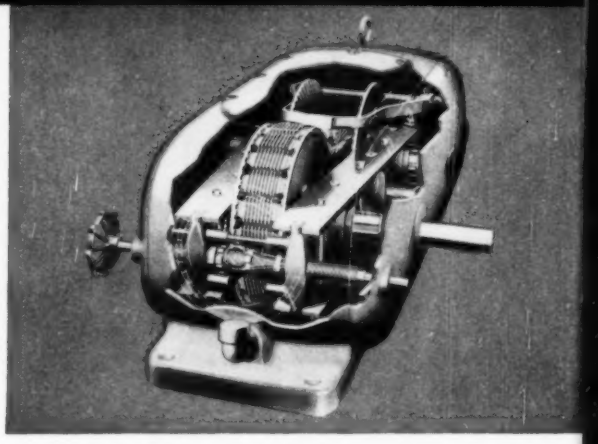
ADDRESS .....

.....





is Speed Reduction Your Problem?



Consult Link-Belt!

Power at the required speed is available through the use of a Link-Belt enclosed gear drive. Regardless of your specific needs for ratio, power or speed, we have the correct answer, and our engineers will be pleased to assist you with your power transmission problems.

Gearmotors

Packaged Power Drives that are compact, economical and highly efficient are available with ratings from 1 to 30 horsepower and output speeds from 280 to 6 R.P.M. These easily-installed streamlined Gearmotors are completely explained in Book No. 1815A, a copy of which is yours for the asking.

PIV Gear Variable Speed Drive

In any process where precise speed is a factor in quality, costs, efficiency or profits, the PIV Variable Speed Drive is the ideal answer to your problem. Built with vertical or horizontal housing, plain or motorized, and with or without enclosed reduction gears. From ½ to 25 h.p. and ratios up to 6:1. Send for Book No. 1874-B.

Worm Gear Drives

For high reduction drive arrangements, these time-proved rugged drives are an ideal answer. Take your choice from a complete line of single, double or helical Worm Gear Drives having horizontal or vertical output shafts and satisfy exactly your requirements. We would be pleased to send Book No. 1824, which describes in detail our Worm Gear Drives.

Herringbone Gear Drives

Link-Belt's large selection of single, double and triple reduction Herringbone Gear Drives adequately fill the bill for small, moderate or large horsepower speed reduction requirements. A mighty good answer to your speed reduction problem. Can we send Book No. 1819 so you can see for yourself?

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities.

LINK-BELT

Power Transmission Machinery
"THE COMPLETE LINE"

"Boss-man really gave me Something to Sell

...when he built-in this **Veeder-Root Counter!"**

Want to build up the morale of your sales force? *Then build a Veeder-Root Counter into your product.* You'll give them something new to sell . . . an added usefulness to your customers . . . a distinctive feature that will set your product apart from your competitors.

Veeder-Root Counters are built, as integral parts, into all types of products from airplanes to machine tools to X-ray tubes . . . to supply facts-in-figures on use, production or performance . . . in any terms or units desired . . . mechanically or electrically. Let a Veeder-Root engineer explore the "uncounted opportunities" for new profit in *your* product. Write to

VEEDER ROOT INCORPORATED, HARTFORD 2, CONN.

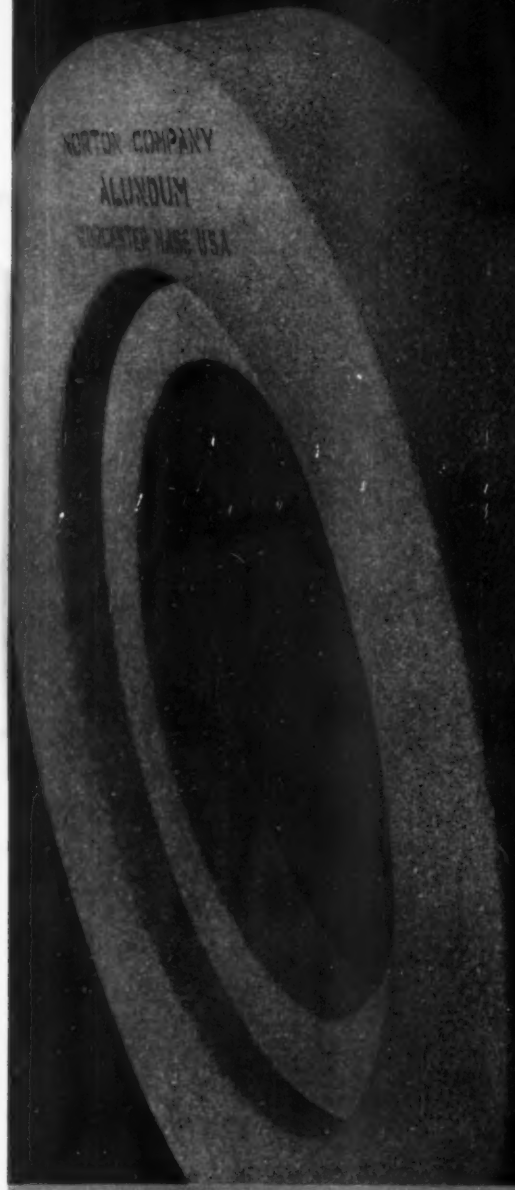
In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3
In Great Britain: Veeder-Root Ltd., Kilspindie Rd., Dundee, Scotland

NEW VEEDER-ROOT 1260 COUNTER

Tops in accuracy and appearance is this compact, streamlined counter in rich 2-tone gray. It can be readily built into a wide range of products to operate as revolution or ratchet counter. . . . 4½" long, 1 9/16" high, 1¼" wide. Counts to million, then resets by turning knob. *Write for 8-page booklet on Standard V-R Counters.*

Veeder-Root COUNTERS

Looking for Lower Cost Cylindrical Grinding?



57 ALUNDUM
abrasive with its combination of sharpness and toughness is first choice for a great majority of the cylindrical jobs on steel.

32 ALUNDUM
abrasive with its extra sharpness and coolness of cut is especially effective on many parts made of hardened steel.

ALUNDUM
abrasive (regular) has a toughness that makes it especially suitable for heavy stock removal and severe sharp corner work.

CRYSTOLON
abrasive has the combination of hardness and sharpness necessary for cast iron and the nonferrous metals.

Abrasives - Grinding Wheels - Grinding and Lapping Machines - Refractories - Porous Mediums - Non-slip Floors - Norbide Products - Labeling Machines

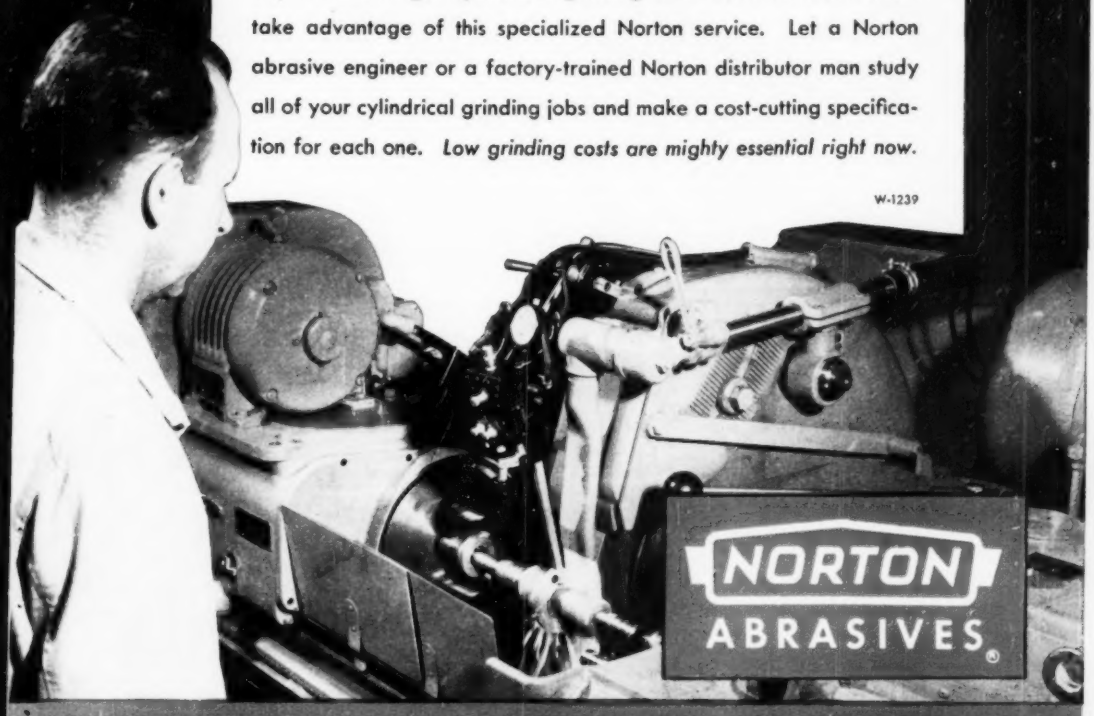
Then Put These NORTON ABRASIVES to Work on All Your Cylindrical Jobs

IF you ripsaw a board with a crosscut saw you'll get the job done but you don't expect maximum efficiency. It's just the same with your cylindrical grinding jobs. There are lots of wheels that will do each job but there's only one wheel that will do each job at the *very lowest possible grinding cost.*

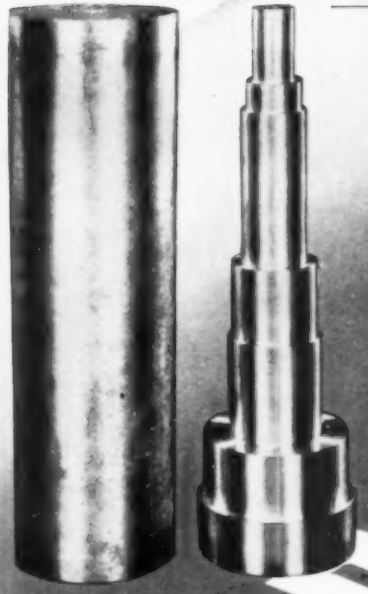
That's why Norton has several different abrasives for cylindrical grinding—each with its own special characteristics, a number of bonds and a wide variety of grains, grades and structures.

If you want to get cylindrical grinding costs down to rock bottom take advantage of this specialized Norton service. Let a Norton abrasive engineer or a factory-trained Norton distributor man study all of your cylindrical grinding jobs and make a cost-cutting specification for each one. *Low grinding costs are mighty essential right now.*

W-1239



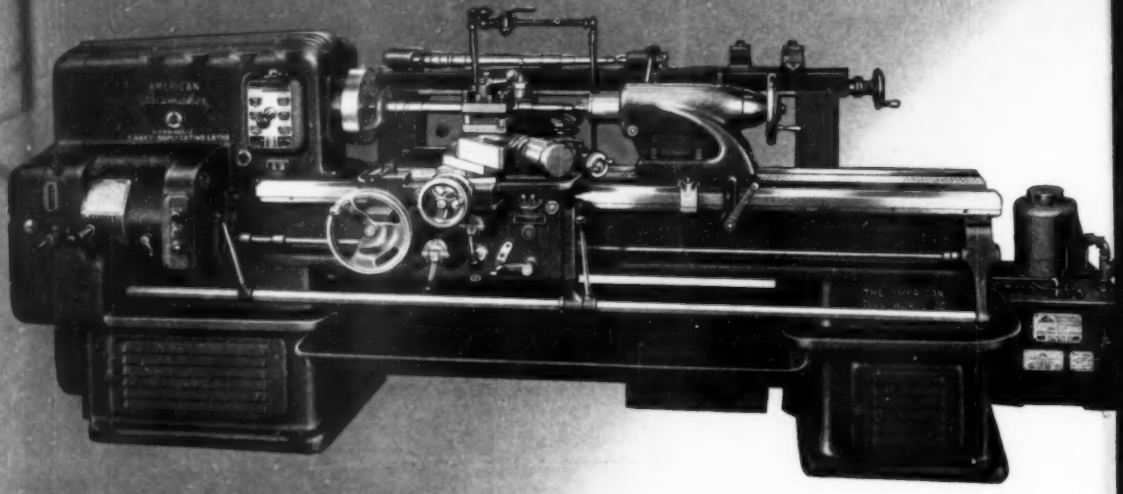
NORTON COMPANY, WORCESTER 6, MASS. • Warehouses in Five Cities • Distributors in All Principal Cities



- **Duplicator Time 14 Minutes**
- **Former Time 48 Minutes**

Material.....4½" SAE 4145
Depth of Cut.....½".
Speed.....255 f.p.m.
Feed.....016".
Total Time,
Rear to floor...14 minutes.

PRODUCTION COSTS



THE AMERICAN TOOL WORKS CO.

SHATTERED

4¼" step shaft of SAE 4145 steel being machined complete in 14 minutes on 16-inch "American" "H S-D" Lathe.

. . . by the new Hydraulic Duplicating technique introduced by "AMERICAN"

The new "American" Hydraulic Shaft-Duplicating Lathe is a thoroughly engineered development for reproducing work shapes from a template by means of a hydraulically controlled cutting tool. The template holder and tracer head are built in at the rear of the lathe where they will not obstruct the operator's vision of the work or interfere with loading and unloading. All operating controls are located at the front of the lathe.

It is faithful and accurate in its reproduction.

It will reproduce steps, tapers, right angle and tapered shoulders, recesses, grinding necks and radii and is especially adapted to the production of such work as spindles, motor shafts, valve stems, back shafts, piston rods, axles—and a wide variety of chuck work having irregular contours.

A single hydraulic system is employed for operating the hydraulic tracer valve and the piston which controls the movement of the tool slide carrying the cutting tool. This simplicity is an outstanding feature and insures accurate reproduction, freedom from failures and elimination of work rejects.

This new metal cutting technique permits continuous cutting without interruption for measuring or calipering at feeds and speeds to the cutting limit of Cemented Carbide tools. "Miking" is confined to the first diameter only after which all other diameters are secured automatically.

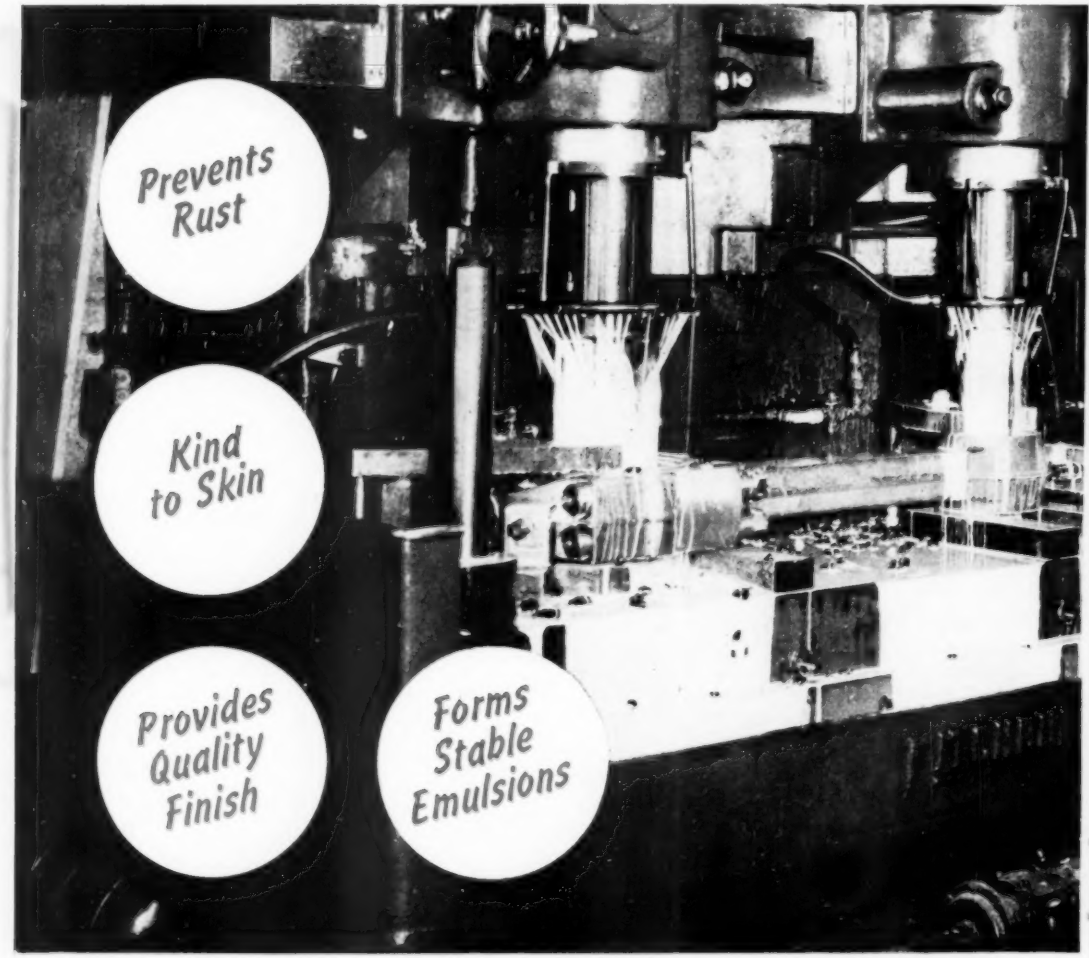
This machine may be quickly converted to standard lathe operations.

Descriptive Bulletin No. 35 sent upon request.

Cincinnati, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Sinclair EMULSICOOL Fine Product



SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

Gives Finish at Less Cost

One of the ever-present concerns in metal working production shops is cost of production. In many operations the use of Sinclair EMULSICOOL as the cutting fluid helps solve this problem. Without sacrificing tool life EMULSICOOL provides high quality finish at less cost.

EMULSICOOL mixes easily with any water—hard or soft—to form stable emulsions. EMULSICOOL has rust protective qualities, too. It does not affect the operator's skin and eliminates troublesome gumming of the machines.

For fine finish, clean operation, easy handling and rust protection, EMULSICOOL is the ideal economy soluble oil.

Continual research explains the high quality of EMULSICOOL and other Sinclair Oils. Sinclair has recently completed at Harvey, Ill., one of the most modern and complete laboratories for petroleum research and development.

E. W. Isom, Sinclair Vice-President in Charge of Research says: "With the new facilities now made available to us at Harvey, Ill., we expect to find many ways to help industry cut costs through better petroleum products."

INDUSTRIAL OILS

FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

Electrolimit Height Gage transferring basic accuracy from P&W Precision Gage Blocks.

Electrolimit Internal Comparator, set up right at the machine, checking the finish ground hole of an automotive connecting rod.

Electrolimit Snap Gage checking automotive crankcase bearings . . . assuring perfectly matched assembly with similarly graded connecting rods.

2-Station Electrolimit Internal Comparator gaging I.D., squareness and concentricity of a refrigerator compressor part.

Setup of Electrolimit External and Internal Comparators for fast, accurate selective assembly gaging of refrigerator parts.

CONTROL OF QUALITY STARTS AT *Accuracy Headquarters*

No function is so vital to mass production as gaging . . . no equipment is so precisely fitted to the purpose as P&W Electrolimit Comparators. They're made at "Accuracy Headquarters", and that means every element, from design through performance, is controlled with meticulous care by P&W Gage-experienced engineers and precision-trained craftsmen. The result: fast and accurate direct readings to "tenths", even "hundredths" — and a satisfying economy in selective assembly gaging and in quality control all the way down your production line.

The complete story of P&W Electrolimit Comparators appears in these interesting and completely illustrated Bulletins. Shall we send copies?

Electrolimit Comparators checking and grading outside diameters of outboard motor pistons, and wrist pin holes.

Pratt & Whitney

Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

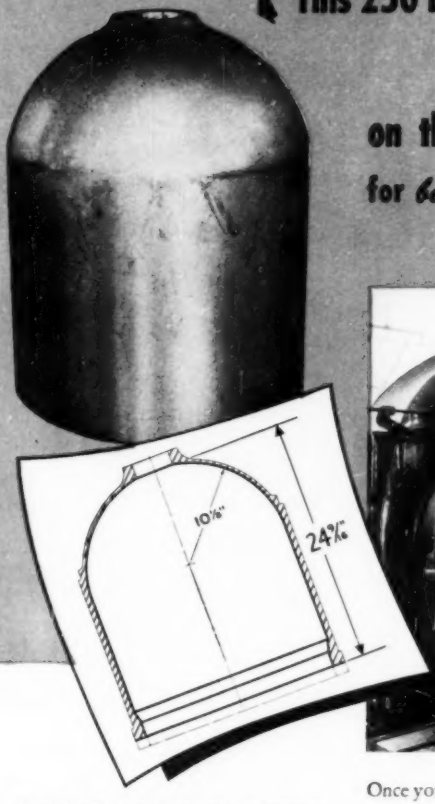
ELECTROLIMIT COMPARATORS

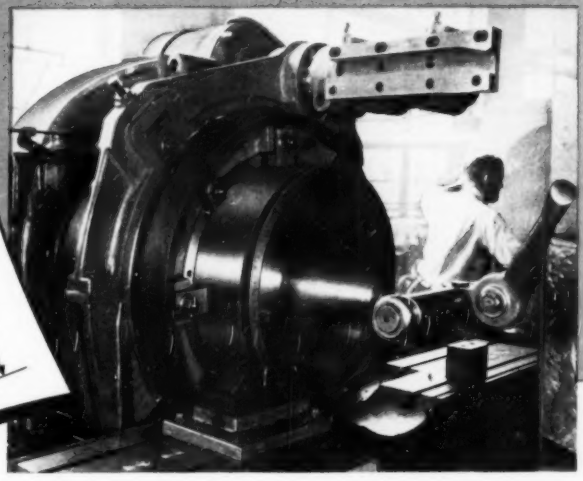
Branch Offices — Birmingham • Boston • Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • New York • Philadelphia • Pittsburgh • Rochester • San Francisco • St. Louis

This 250 Brinell Steel Forging machined with

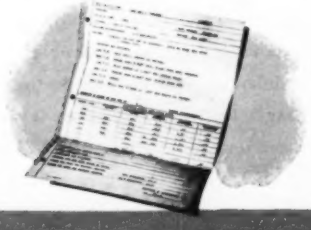
P&J TOOLING on the P&J AUTOMATIC

for *better* production . . . *more of it* per hour *at lowest cost* per piece





We will be glad to quote time and cost figures on any work ranging up to the 6 inch maximum on the 3U Automatic . . . and through the full range of P&J Machines up to the 40 inch maximum on the 8D size. Simply send us a sample of your job . . . we'll work out a detailed Estimate Sheet without obligation — turret face by turret face — with tooling recommendations for precision, speed, and the lowest possible production costs.



Once you're familiar with production machining on P&J Automatics, you'll be impressed with P&J Tooling that's engineered for the job — and the extreme flexibility you get with it. By way of example, here's a job that worked out better by planning a generating cut (not a form-cut) to obtain the 10⅛" inside radius to close tolerance specifications. P&J engineered the Tooling to do just that — and, in a single setup, to bore, face, undercut and taper the surfaces indicated by the heavy lines in the drawing. *That's* the sort of flexibility you get with P&J Tooling on P&J Automatics . . . plus a bonus of fewer rejects, greater accuracy and better work . . . in less machining time.

P&J AUTOMATICS
tooled for
PRODUCTION · SPEED · ECONOMY
at Production Tooling Headquarters

Potter & Johnston Company
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Division Niles-Bement-Pond Company

P&J

How to IMPROVE MILLING METHODS...

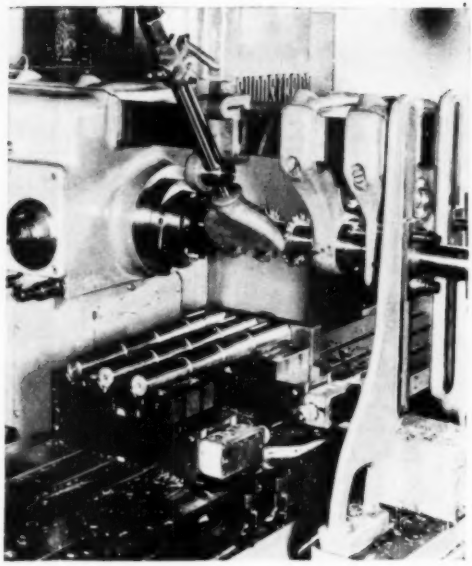
With Sundstrand Machines and "Engineered Production"

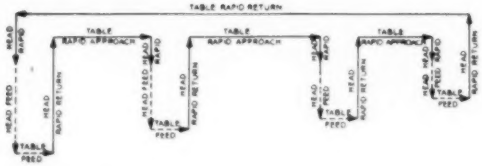
Profitable milling production can be obtained only by lowering *unit* production costs . . . obtaining the most economical solution to your milling problem and the most productive milling equipment in relation to your production requirements.

Basically, there are two approaches to solving these problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary.

This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.



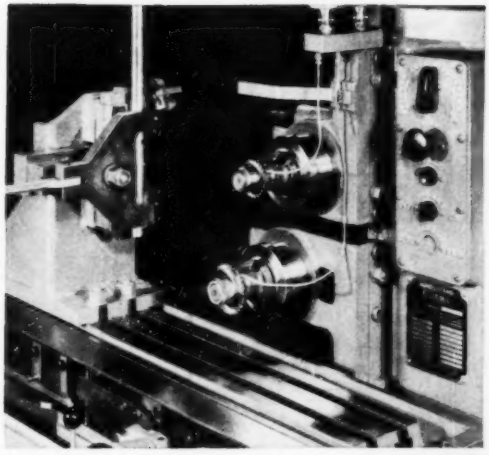


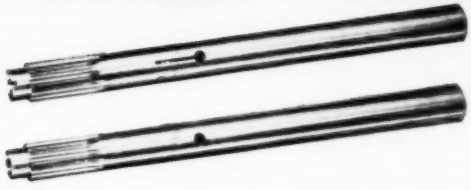
1 Milling Keyways on a Standard Rigidmil

Here's high production on keyway milling with a standard Model 22 Rigidmil. Fifty-four shafts are milled per hour with a total of 216 keyways. A standard vertical feed attachment has been added to the machine. By combining the vertical head cycle and the horizontal table cycle, it is possible to mill four keyways at different depths along the length of the shaft. An easy to load magnetic fixture is used to hold three shafts at a time. The fixture switch is timed with the cycle switch so that a cycle cannot be started until the pieces are clamped. The standard vertical feed attachment provides vertical feed and rapid traverse in combination with the movement of the table as illustrated in the cycle diagram.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

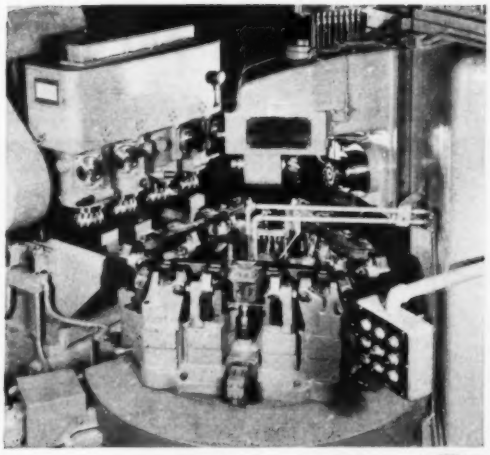
RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT





2 Milling Slots with Semi-Standard Rigidmil

This standard Sundstrand Rigidmil has been provided with a special two spindle milling head. The two horizontal spindles are offset so that while the lower spindle feeds through the diameter of the shaft the upper spindle mills through the O.D. of the shaft to form the slot illustrated. The part is a steel center drive tubing for a washing machine. A simple, manually operated work holding fixture holds one piece at a time, and an automatic table cycle of rapid approach, feed and rapid return is used to complete 74 pieces per hour. The standard dwell attachment for accurate table stop is used to hold the depth of the slots to within .001.

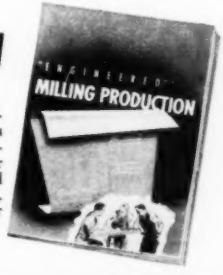


3 Milling Manifolds with Special 6 Spindle Rigidmil

This special Sundstrand Rigidmil consists of a 40" three station index table with three work holding fixtures, a horizontal traveling head with four vertical spindles and a vertical feeding head with two opposed horizontal spindles. All spindles have an adjustable speed range, and the inboard spindle on the vertical traveling head has automatic cutter relief. Each head has a variable feed range and an adjustable feed stroke. The three fixtures permit milling at two stations while unloading and loading at the third. At the first milling station, the four spindle head mills the four port faces. At the second milling station, the two spindle head feeds down to straddle mill the heater and tail pipe pads. Power clamping of the work piece, automatic indexing, and automatic cycling of the heads reduces the operator's duties to loading and unloading and pressing the fixture clamp and cycle control buttons. Production is approximately 154 per hour.

Free Additional Data

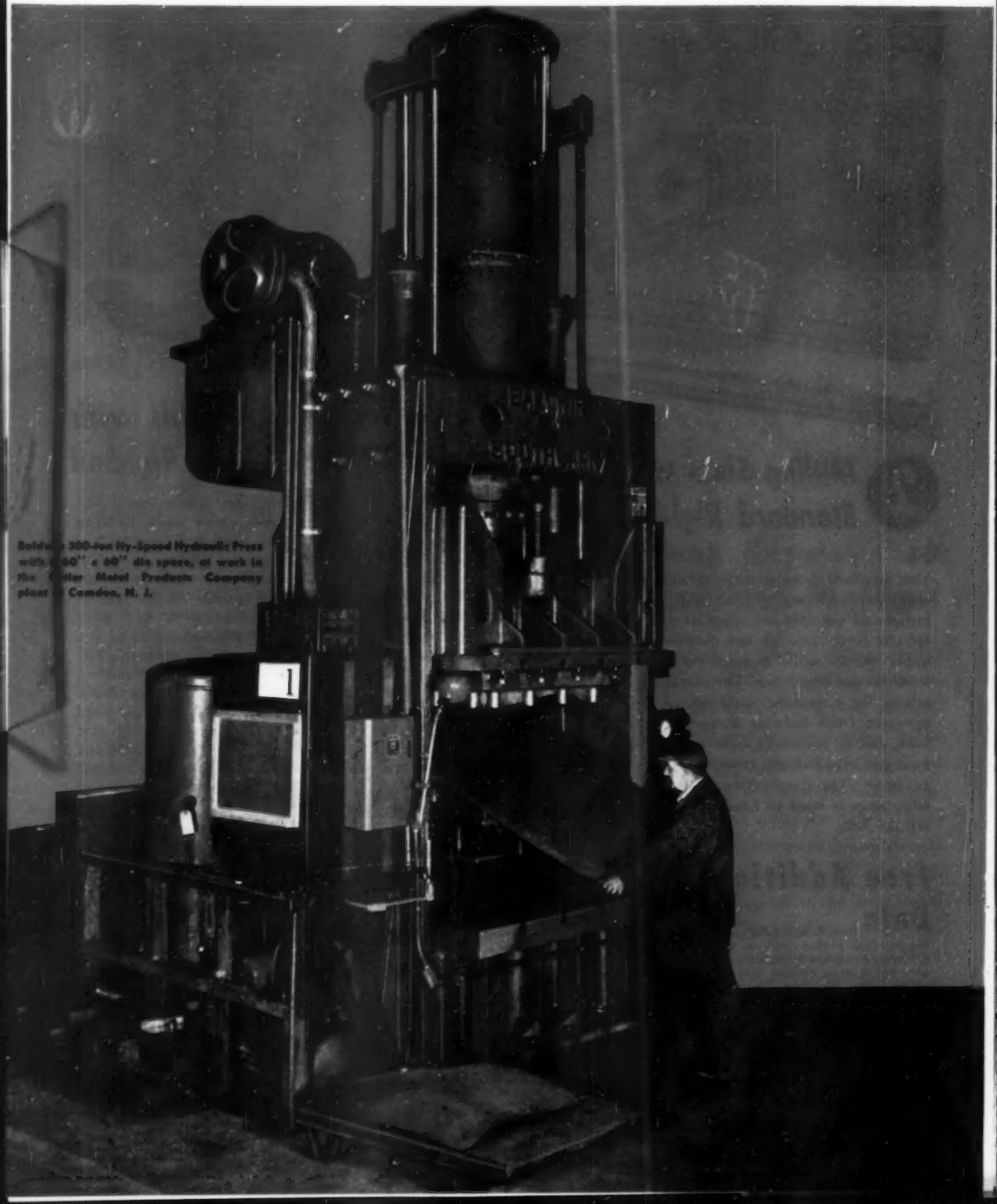
You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for bulletin No. 186.



SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

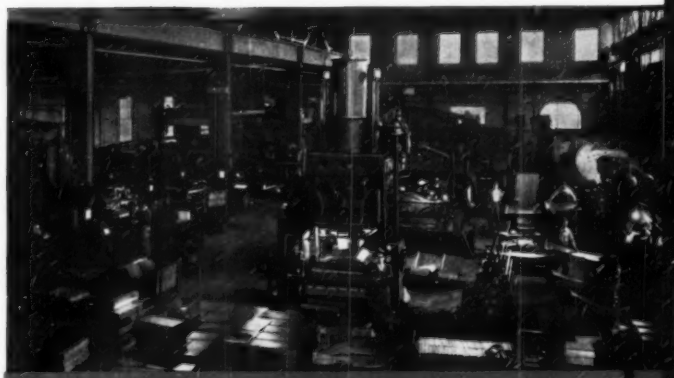
at CUTLER METAL



Baldwin 300-ton Hy-Speed Hydraulic Press with a 50" x 60" die space, at work in the Cutler Metal Products Company plant in Camden, N. J.

PRODUCTS COMPANY

this Baldwin "exceeds expectations!"



An important producer of all types of industrial sheet-metal and fabricating work on both short-run and high production schedules, the Cutler Metal Products Company regards its Baldwin 300-ton Hy-speed Hydraulic Press as "one of the finest pieces of equipment in the plant". Since the facilities include a complete tool and die shop, welding equipment of all types including automatic arc, shearing and braking facilities to handle plates up to 12' wide x ⅜" thick, and press equipment ranging from 10-ton units up, all modern and efficient, this tribute to the Baldwin press is particularly impressive and significant.

Some of the many products which the Baldwin Press helps to produce at top speed and rock-bottom cost are illustrated at right.

Mr. Abraham Z. Cutler, vice president, stated that the Baldwin unit had "more than lived up to expectations, and completely justified every claim". In reviewing the features of the press, he pointed out the following as making vital contributions to the sustained production records established by the unit.

1. *Controlled pressure* on the work, based on the resistance of any one point.
2. Die interchangeability, because of the absence of a fixed working stroke.
3. Complete control of the slide at every portion of working and return stroke, insuring a more uniform product.
4. The small number of moving parts and the straight-line motion of the ram, free from heavy side thrusts. This helps to hold maintenance to a minimum.

Cutler is just one of a number of progressive metal working organizations that have found the key to better, faster, more profitable production in a Baldwin Hydraulic Press. Ask for Bulletin 160—and ask, also, for a representative to call and discuss your press requirements with you.

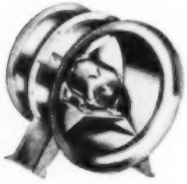
The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.

BALDWIN BLW THE BALDWIN GROUP

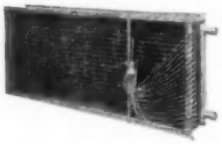
HYDRAULIC PRESSES

MORE FEATURES THAT REALLY COUNT-- IN THESE STURTEVANT HEATERS

REFRIGERATION COMPRESSORS



AXIAL FLOW FANS



HEATING AND COOLING COILS

Why? Because these heaters are the product of the combined experience of two great leaders—Westinghouse in electricity; Sturtevant in heating and ventilating. This means, too, that you get undivided responsibility, superior performance and a wide range of capacities to choose from — assuring the most efficient heater to fit your particular needs. For years of uninterrupted heating service, get in touch with your nearest Sturtevant office, or, write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

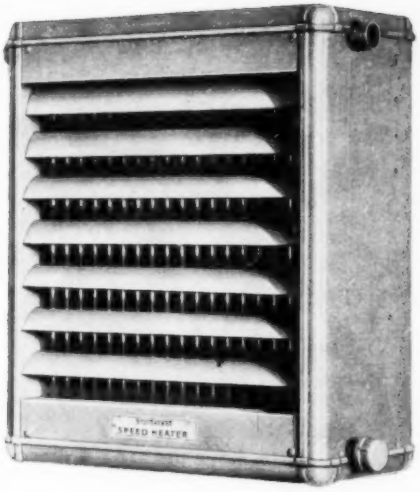
Everything that puts air to work for Every application

REFRIGERATION CONDENSERS

CENTRIFUGAL FANS

UNIT AIR CONDITIONERS

J-80144



SPEEDHEATER®

1. Fast Heat Delivery—Assured by efficient, quiet-operating fan
2. Low Maintenance Cost—Single-row radiator assures uniform tube expansion, freedom from radiator distortion. Longer life. Tested for 200-lbs. steam pressure
3. Dependable Westinghouse Motor—Backed by nationwide Motor Service Plan
4. Simplified Installation—Inlet and outlet connections on either side
5. Easily formed Handy Hangers—At no extra cost
6. Capacities—From 25,000 to 300,000 Btuh

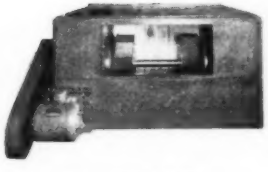
DOWNBLAST SPEEDHEATER

1. Excellent Heat Distribution for High-ceiling Applications
2. Greatly Reduced Ceiling Heat Loss, Lower Fuel Costs
3. Connections on Both Sides Save Piping Costs
4. Capacities From 40,000 to 450,000 Btuh

MULTIVANE HEATER

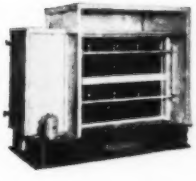
1. Large Volumes of Heated Air, Evenly Distributed
2. Rugged, Simple Construction; Working Parts Easily Accessible
3. Installed on Floor, Wall or Ceiling
4. Capacities, 44,100 to 1,177,000 Btuh

Westinghouse
Sturtevant Division



AIR HANDLING UNITS

PRECIPITRON®
(ELECTRONIC AIR CLEANER)



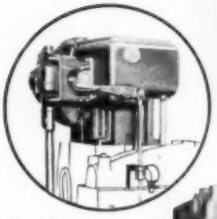
SURFACE DEHUMIDIFIERS

FROM

Splines to Worm Gears

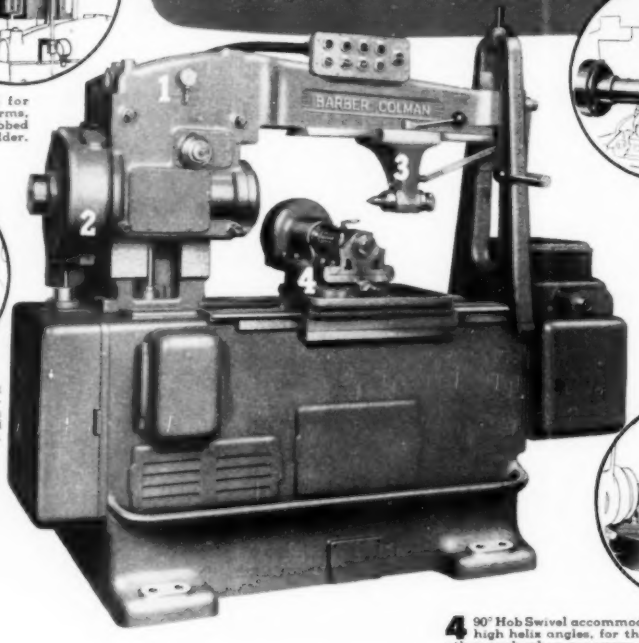
QUICK-CHANGE ON THE BARBER-COLMAN No. 16-16 HOBBING MACHINE

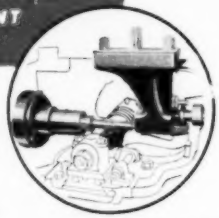
WITH THIS EXTRA EQUIPMENT



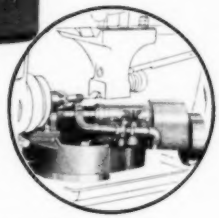
1 Power Vertical Feed for "infeeding" to cut worms, threads, worm gears, or hobbed surfaces adjoining a shoulder.

2 Rear Overarm Support provides rigidity and accurate centering for extra long shafts which extend through the work spindle.





3 Flat Center Bracket for small diameter work, or when necessary to run the hob directly under the tail center.



4 90° Hob Swivel accommodates extremely high helix angles, for thread milling or other work when necessary to align axis of hob and work parallel.

The No. 16-16 is a highly versatile machine for the rapid production of splines, gears and a variety of gear tooth shapes. With the addition of some extra equipment, the standard machine is made even more flexible in production. Changeover from one job to another is greatly simplified and set-up time becomes a minor factor.

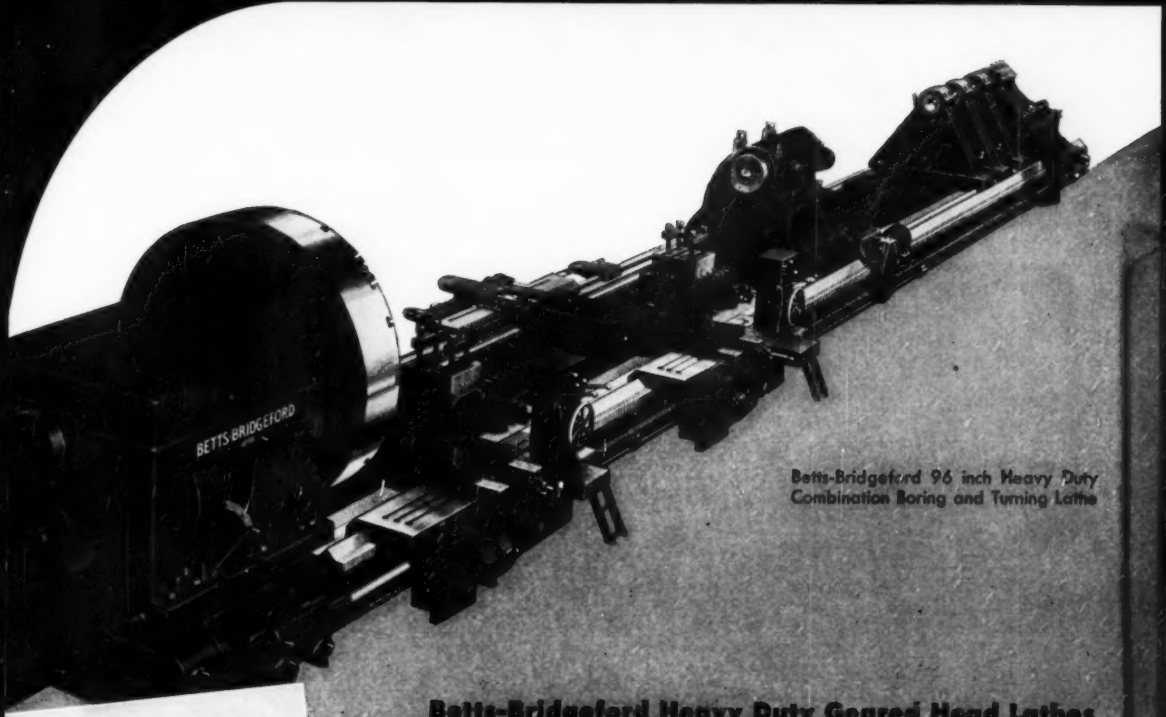
Ask your Barber-Colman representative about the advantages of this equipment. He can quote specific figures and jobs for comparison with your own work. Send for this new Bulletin No. 1133.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 1133 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

BARBER COLMAN

BETTS-BRIDGEFORD
Heavy Duty Geared Head
LATHES



Betts-Bridgeford 96 inch Heavy Duty Combination Boring and Turning Lathe

Betts-Bridgeford Heavy Duty Geared Head Lathes are built from 26 to 144 inch swing and larger

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

An earnest effort to produce the world's finest heavy duty machine tools has gone far to establish Consolidated's enviable reputation for designing and building heavy duty geared head lathes . . . a record of achievement extending back to the first Betts-Bridgeford Geared Head Lathe built in 1905. Today's Betts-Bridgeford Lathes have every advanced feature required for modern high production, accuracy and durability.

Full information covering any size Betts-Bridgeford Heavy Duty Lathe will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

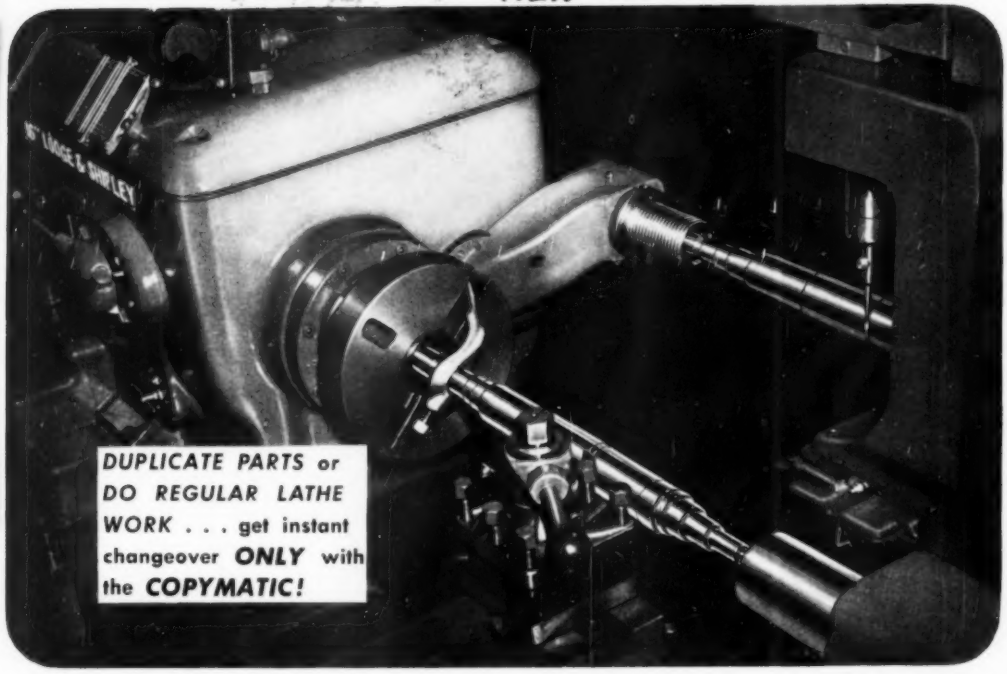
BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

TURNING TIME CUT 1/2

at LINK-BELT COMPANY, Philadelphia with the *NEW* LODGE & SHIPLEY COPYMATIC Lathe



● Quickly recognized by industry, the versatility and exceptional productive capacity of the New Lodge & Shipley COPYMATIC Lathe is already serving many alert manufacturers. One of these is the Link-Belt Company, whose Philadelphia Plant reports 50% savings in machining time plus other economies . . . on the COPYMATIC. Numerous exclusive Lodge & Shipley profit features are termed "Excellent."

The illustration above shows one of "various general lathe jobs" performed on the 16 in. Model "X" COPYMATIC Lathe. A motor shaft of SAE 1040 heat-treated steel is being turned, grooved and radii finished by automatic tracer control. NOTE: *Link-Belt is using a stock shaft for the template, eliminating cost and time involved in making a special template* . . . typical of the simplicity of operation designed into the COPYMATIC.

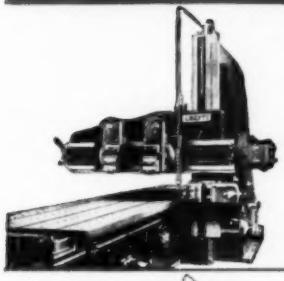
If you're looking for more and better production . . . check the COPYMATIC. This newest development, combining the speed and convenience of automatic duplication . . . proven "Model X" efficiency . . . and instant changeover from duplication to regular lathe operation, is the talk of the shop and cost department too! Write for Bulletin No. 675.

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

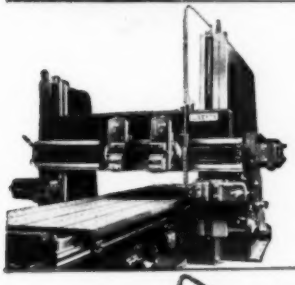
LIBERTY

BUILDS 3 great PLANERS



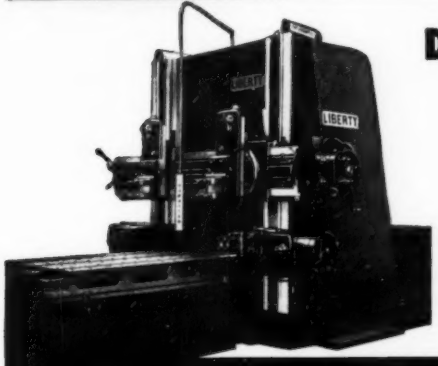
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

Write for catalog giving complete details.

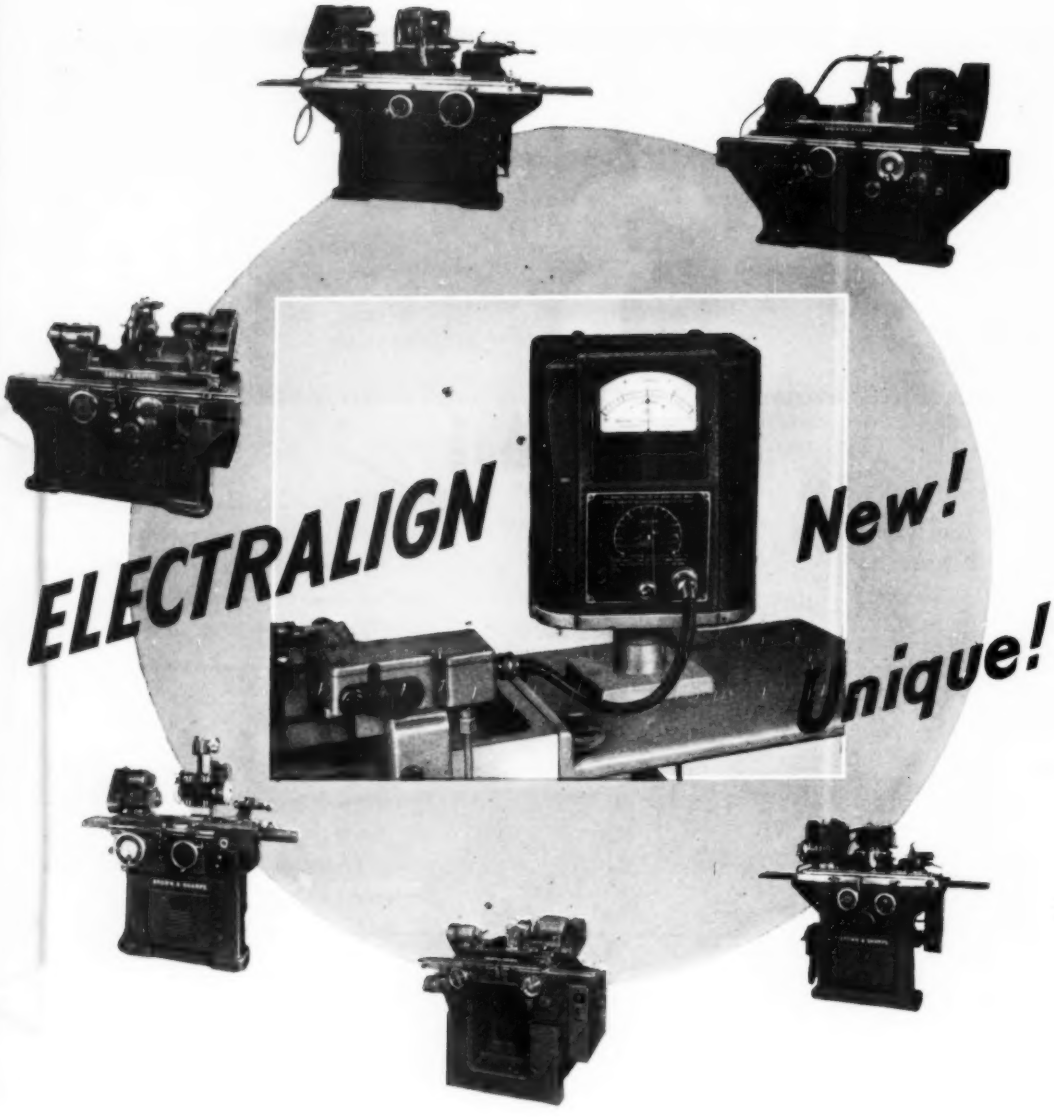
All lengths, 24" x 24" wide and larger.

LIBERTY PLANERS, INC.

HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

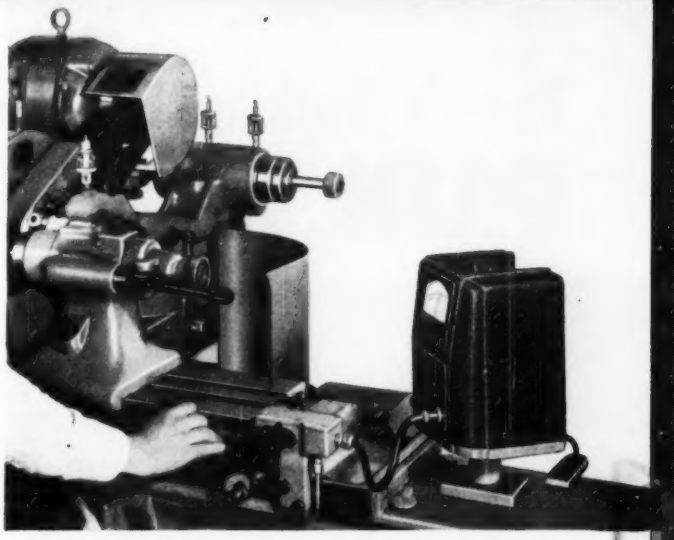


NOW AVAILABLE WITH THESE BROWN & SHARPE MACHINES

- **Nos. 1, 2, 3 and 4 Universal**
- **No. 5 Plain** (3″ x 12″ and 3″ x 18″)
- **No. 10 Plain** (6″ x 18″ and 10″ x 18″)
- **No. 12 Plain** (6″ x 30″ and 10″ x 30″)
- **No. 20 Plain** (10″ x 18″)
- **No. 22 Plain** (10″ x 36″)
- **No. 23 Plain** (10″ x 48″)
- **No. 13 Universal and Tool**

BROWN &

NOW—a revolutionary development to simplify grinding set-ups!



ELECTRONIC ALIGNMENT OF SWIVEL TABLE on Cylindrical Grinding Machines

With an Electralign-equipped machine, the hardest part of grinding straight work and exact tapers is made easy and positive. This exclusive device permits the operator to align a swivel table fast and accurately after only one preliminary grind. It also permits correction during the grinding operation.

Electralign makes use of sensitive electrical resistance wire strain gages to detect swivel table movements and an electronic amplifier to magnify these movements. Deflections are direct reading . . . no interpolation or transposition of figures needed.

AVOIDS COSTLY CUT-AND-TRY OPERATIONS IN GRINDING STRAIGHT WORK AND EXACT TAPERS

With Electralign, there is no need of regrinding several test pieces in order to obtain proper adjustment. Displacements of as little as .0001" are easily detected . . . and are amplified to well spaced graduations on the indicating scale. Only one setting is necessary for the correction.

PROVIDES CONTINUOUS VISUAL CHECK

The Electralign acts as a "watchdog" . . . as grinding progresses, any deviation of instrument needle from zero warns operator that some jar or vibration has changed the setting of swivel table. It does much to eliminate costly spoiled work.

MANY COST-CUTTING ADVANTAGES

With Electralign, you can handle *more* straight and taper grinding . . . faster. You can reduce rejects . . . perhaps eliminate them altogether. You can remove the tension and pressure that usually goes with precision work. New operators can be trained much easier and faster. The extreme simplicity and reliability in operation of this arrangement makes it very practical for shop use. Write for complete details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

ALSO AVAILABLE: Brown & Sharpe Electralign-Comparator Selector allows use of comparator for external or internal measurements of finished work. Only one amplifier needed for electronic alignment plus measurement of work.

SHARPE B·S

There's Nothing Else Like It: USERS GAIN IN PRODUCTION

FORTY-EIGHT per cent savings — floor-to-floor time! That's the actual result on this job — milling the face of worm-wheel housings. *Mono-Lever controlled* reciprocal milling did the trick. Operator determined cycle and set trip dogs — a matter of seconds. Then using the speedy setup and workholding facilities of the Built-in Chucking Table (a new, exclusive Kearney & Trecker development for simplifying setups and for easy holding of irregular shaped workpieces) he made his setup. Then engaged the *Mono-Lever* — and kept busy loading new workpieces.

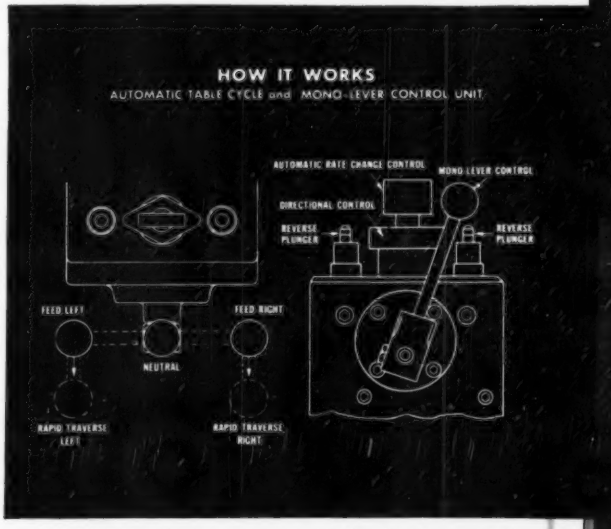
REPORT 16% TO 96% AND LOWERED COSTS

YOU bet there's nothing else like it! We mean the results users are getting with Kearney & Trecker's *new line of* knee-type milling machines with combined *Mono-Lever* control and Automatic Table Cycle. These users are cost-conscious plants. They know what they're talking about when they report increased efficiency — savings of 16 — 31 — 43 — 96% on all kinds of milling work.

Yes, more and more alert, cost-minded production men are buying these new Kearney & Trecker milling machines. Why? Because they've seen the five important profitable things these machines can do: (1) slash idle cutter time; (2) reduce operator fatigue; (3) improve uniformity of finished work; (4) provide greater adaptability in their shop equipment; (5) *return their investment faster.*

Compare these machines with all others on this important five-point basis. You won't be disappointed!

For some startling facts about these new machines as applied to your milling work, consult a Kearney & Trecker Sales Representative, today. Schooled in the "know-how", he's at your service — or write direct: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.



THINK OF IT! Now you can have all the advantages of this great cost-cutting feature plus the all-around versatility of general purpose, knee-type machines . . . faster, easier control for greater production with less operator fatigue.

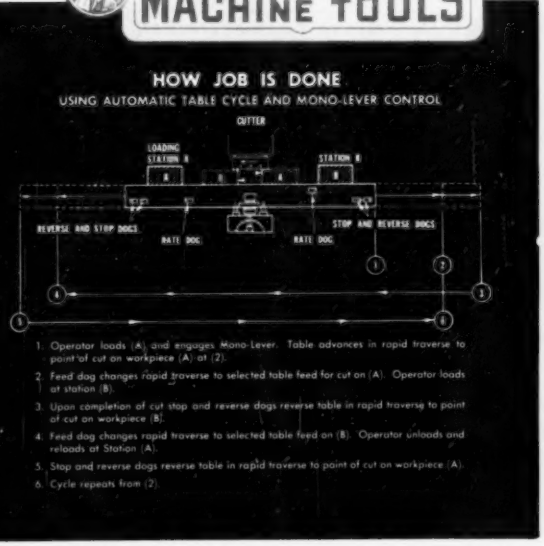
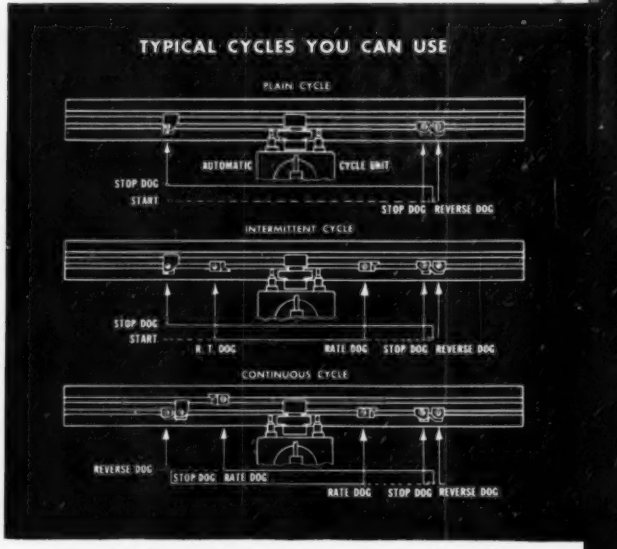

HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL
CUTTER
LOADING STATION A
STATION B
REVERSE AND STOP DOGS
RATE DOG
RATE DOG
STOP AND REVERSE DOGS
1. Operator loads (A) and engages Mono-Lever. Table advances in rapid traverse to point of cut on workpiece (A) at (2).
2. Feed dog changes rapid traverse to selected table feed for cut on (A). Operator loads at station (B).
3. Upon completion of cut stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (B).
4. Feed dog changes rapid traverse to selected table feed on (B). Operator unloads and reloads at Station (A).
5. Stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (A).
6. Cycle repeats from (2).

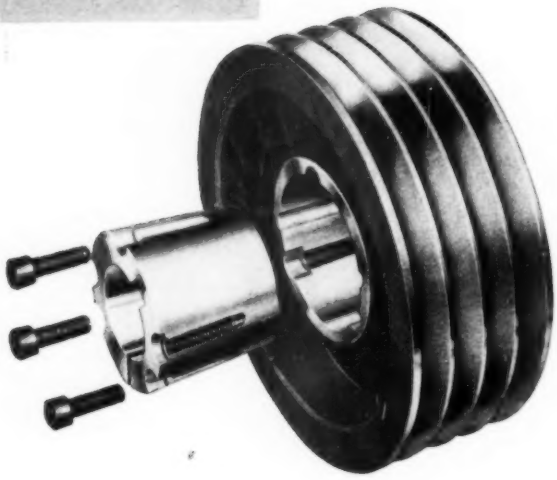
DIAGRAM shows how Mono-Lever control and automatic table cycle does this job. Operator takes approximately 45 seconds to set trip dogs for feed, rapid traverse and reverse. Engages Mono-Lever only once for entire run . . . spends the rest of the time loading and unloading workpieces.



THREE DIFFERENT TYPICAL CYCLES to accommodate various job setups. Using the completely automatic cycle feature effects savings of up to 31% for lots of 10 or more pieces. Cycle can be set for loading and unloading time — and can be reversed in feed or rapid traverse.

The simplest, surest mechanism ever devised for holding wheels to shafts

Holds fast to the shaft with firmness equivalent to a shrunk-on fit



No flange — no collar. Easy on, easy off. Slip it on and tighten while sighting

Stocked in complete range of sizes in Dual Duty (A and B); B, C and D grooves

A Great, Time-Saving Development—

TAPER-LOCK

Trade Mark

V-BELT SHEAVE

This is one of the century's biggest developments in power transmission equipment—another Dodge "first." Simpler, tighter-fitting, truer-running, infinitely easier to handle. Saves installation time and results in neater applications—in the plant or on your product.

Dodge's sole business is to "get the power through"—smoothly, steadily, economically. To succeed in this business Dodge has developed *many* products that are outstanding in the field of mechanical power transmission. Your Transmissioneer, the local Dodge Distributor, is equipped to give you valuable information on new and better ways to transmit power.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, IND.

OTHER DODGE "FIRSTS"

Dodge-Timken Bearing. 4 basic types in a vast range of sizes.

Taper-Lock Flexible Coupling. Ready to install without reboring.

Rolling Grip Clutch. No toggles! Flexible. Positive.

"SC" Ball Bearing with new Neoprene metallic-backed seals.

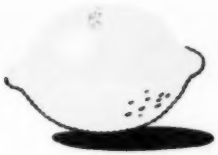
DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS



SOUR ON IT!

Machining heavy metal castings hogged the profits of a dictating machine manufacturer. Competition was forcing him to a lightweight model. He knew magnesium was light and strong, but was sour on it. Then he took his problems to Aluminum Company of America, light metal headquarters. He learned simple shop practices make handling magnesium no problem.* He found that fellow manufacturers every month are using over a million pounds of magnesium. He learned magnesium castings machine fast and have a high strength-weight ratio. He got books on designing and fabricating magnesium, plus all the technical aid he needed. Now, he buys magnesium sand and permanent mold castings from American Magnesium Corporation and gets prompt delivery. Machining and handling costs dropped, profits soared. His new lightweight model squelches competition.

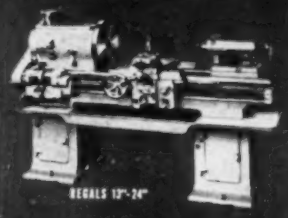
*No change in insurance rates.

These two, free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, sales agent for American Magnesium Products, 2107H Gulf Building, Pittsburgh 19, Pennsylvania.

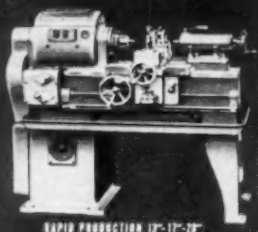
MAGNESIUM MAZLO® PRODUCTS

AMERICAN MAGNESIUM CORPORATION

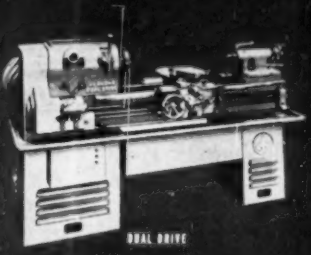
SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA



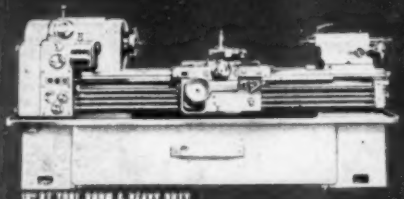
REGALS 13"-24"



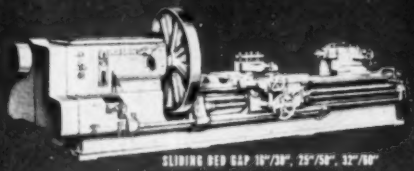
RAPID PRODUCTION 13"-17"-20"



DUAL DRIVE

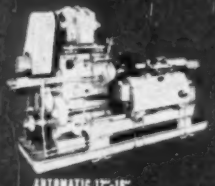


13" AT TOOL ROOM & HEAVY DUTY



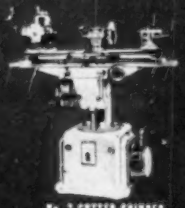
SLIDING BED GAP 10"/30", 25"/50", 32"/60"

More Lathes mean Greater Choice, Better Buy!



AUTOMATIC 12"-16"

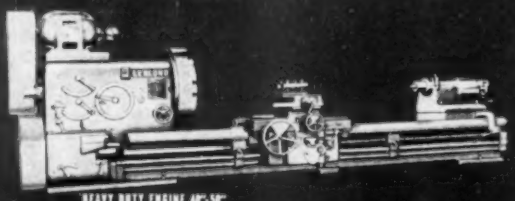
HEAVY DUTY ENGINE 12"-32"



No. 2 CUTTER GRINDER

UNIVERSAL CRANKSHAFT 28"-36"

HOLLOW SPINDLE 18"-30"



HEAVY DUTY ENGINE 48"-56"

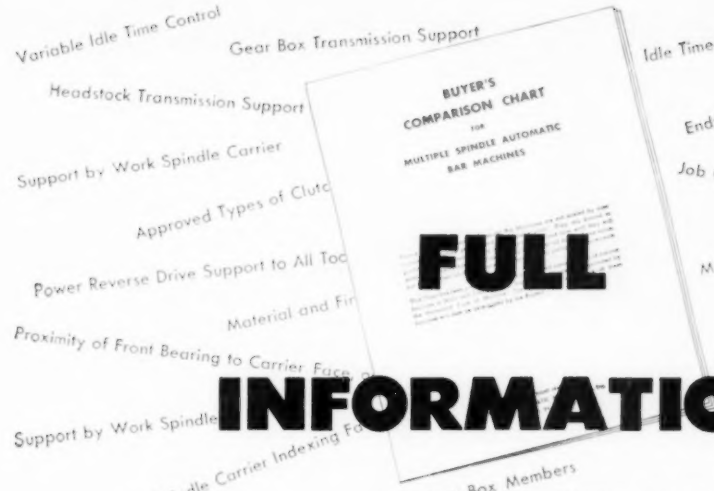
AUTOMATIC CRANKSHAFT

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

NEW YORK 6, N. Y., Singer Bldg., 149 Broadway, COrtland 7-6621
CHICAGO 6, ILL., 20 No. Wacker Drive, STAte 5561
PHILADELPHIA 40, PA., Beury Bldg., 3701 N. Broad, SAgamore 2-5900
DETROIT 7, MICHIGAN, New Center Building, TRinity 3-5561

LeBLOND



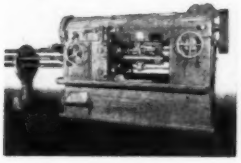
FULL INFORMATION PLEASE

Buyers of machine tools usually want ALL of the information about a machine, not just a part of it. And, with all of the information, they will give special attention to those things that have a bearing on their own particular requirements.

Case histories of machine performance in other plants clearly indicate that requirements often vary. But, for any requirement, machine performance is dependent on machine facility, and there is no better way of predetermining satisfactory quality performance than by determining a machine's quality facility.

All brands of a given type of machine offer value worthy of due consideration. A fair comparison of their facilities, in accordance with the requirements they must meet, is a logical means of establishing a preference.

For those interested in determining the facilities of multiple spindle automatic bar machines CONE has made available an analysis chart. It is designed to help guide you to ALL the information. Your copy is free. There is no obligation.



A comparison will lead you to

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

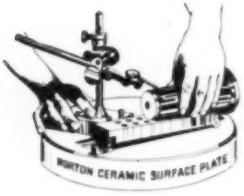
The Leader in Precision

The Norton CERAMIC Surface Plate

THE flat, smooth, wear-resistant surface of the Norton Ceramic Surface Plate has, in the few short months this plate has been on the market, established it as a leader in precision work. And in severe production gaging and blueing operations this ceramic surface plate shows to even better advantage.

You will find it to your advantage to use Norton Ceramic Surface Plates for these reasons:

1. ***Wear-resistance.*** Made of one of the hardest substances known, these plates can undergo months of severe use without measurable wear.
2. ***Flatness.*** Guaranteed to be flat within .0001", the Norton Ceramic Surface Plate assures perfect accuracy of precision measuring operations. And it stays flat because it will never warp nor deform; it gives no expansion troubles and will not deflect under load.
3. ***Smoothness.*** The Norton Ceramic Surface Plate offers a new standard of continuously smooth surface finish that allows easy movement of instruments and work across the plate and prevents wear of expensive instrument bases, gage blocks and sine bars.



In addition to these three advantages, the Norton Ceramic Surface Plate has other important qualities: it is ideal for blueing; it will not corrode; and it is non-magnetic.

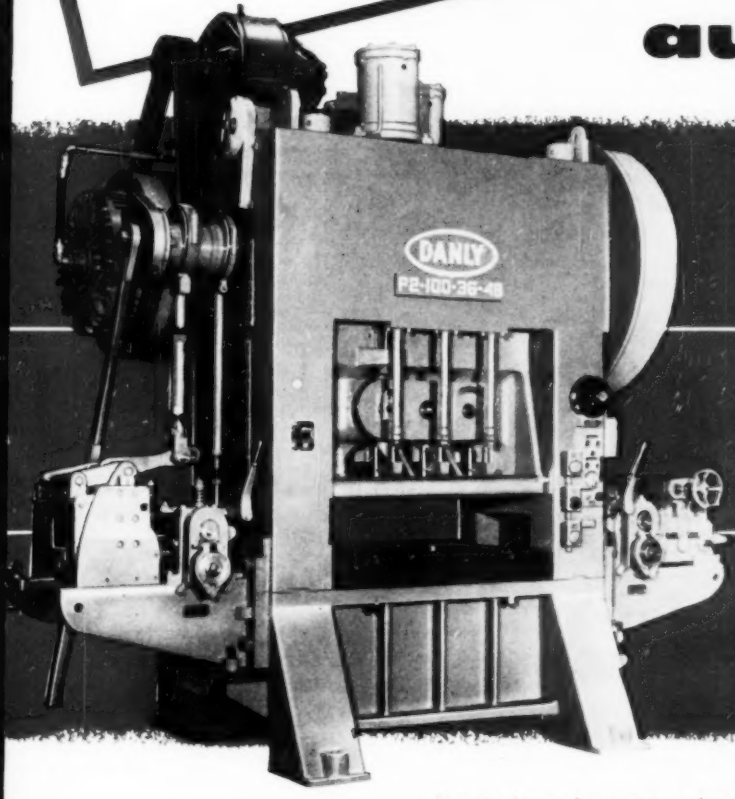
NORTON COMPANY
Worcester 6, Massachusetts

For more information on the longest-wearing precision surface plates ever made, write: Norton Company, Worcester 6, Massachusetts, for Bulletin No. 1174.

NORTON
CERAMIC SURFACE PLATES

...designed to reduce stamping costs!

the new DANLY autofeed



HIGH CAPACITY

HIGH SPEED

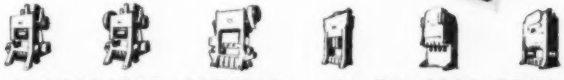
LESS DOWN TIME

Here is the modern press...developed specifically to meet modern production requirements and permit application of new, more economical stamping methods.

Send for this booklet

Check the special construction features of the modern Danly AUTOFEED *Presses . . . see how a Danly Press will cut your stamping costs.*

DANLY



MECHANICAL PRESSES....50 TO 3000 TONS

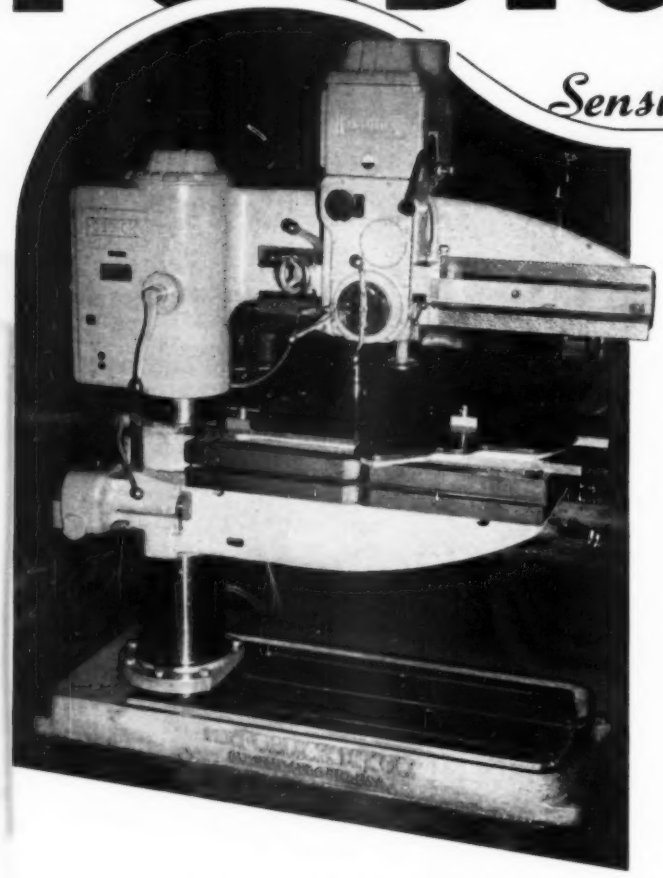
IT COSTS LESS TO RUN A DANLY PRESS

DANLY MACHINE SPECIALTIES, INC. • *2100 South 52nd Avenue, Chicago 50, Illinois*

FOSDICK

Sensitive **RADIAL**

. . . ideal for template drilling



● The combined advantages of Radial design and Sensitive drilling make this machine ideal for template drilling. The adjustable, swinging table also works out advantageously on this job as well as many other types of work.

Note that the head, located at a fixed height within normal reach of the operator, and the table swing in an arc of 360°. The table can be equipped with power elevation with safety trip at the top and bottom of extreme travel.

All speed and feed controls are located on the head for operating convenience. The machine handles sensitive drilling, reaming, tapping and similar operations on holes up to 1½ inch diameter.

Regardless of whether you operate a large or small shop here's a machine that fits into your production lineup.

For full details write for bulletin Fosdick Sensitive Radials S.R.A.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

New Texrope Sheave Gives Lowest Cost

Instant Speed Control

- Covers most speed changing needs from 3 to 20 hp
- Very simple — one sheave does all
- Infinitely variable speed — 100% increase; 2 to 1 range.

THE NEW *Vari-Pitch* AUTOMATIC SHEAVE is the simplest, most economical method of instant speed control ever devised. You just move the motor forward to increase speed and move the motor back to decrease. The *Vari-Pitch* Automatic Sheave changes pitch diameter and holds the belts at proper tension *automatically*.

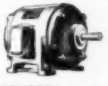
Now, you can cut unit costs by operating machines at most efficient speed . . . improve quality by compensating for material variation . . . with a very small investment in new equipment. Today, ask your A-C Authorized Dealer or Sales Office to give you complete facts and figures on how the new *Vari-Pitch* Automatic Sheave can save money in your plant. Or write for bulletin 20B7223. A-2767

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



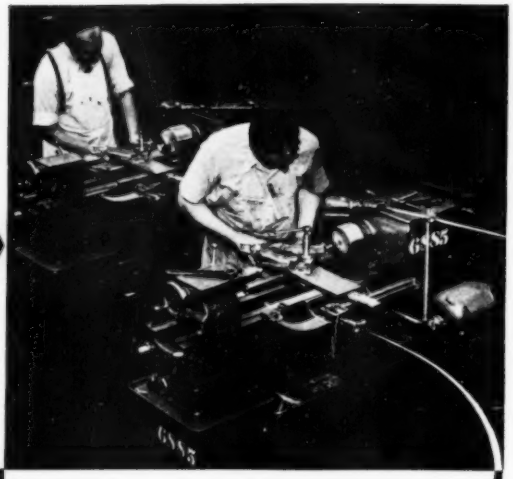
MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

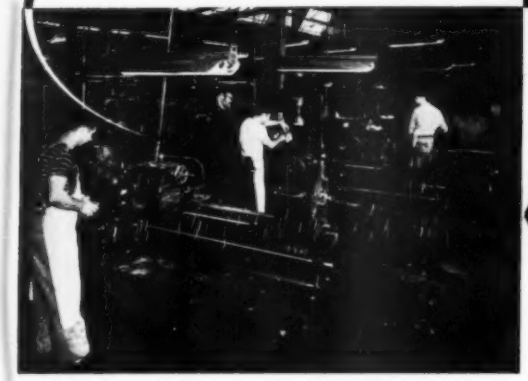
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS

from Connecticut

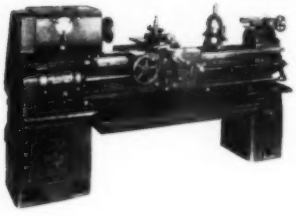


Two 10" Tray-Top Cintilathes in use in the shop at Pratt & Whitney Aircraft, West Hartford, Conn.



Three Tray-Top Cintilathes in service at Wells Aircraft Parts Company, Los Angeles, Calif.

to California



Wells Aircraft bought its first Tray-Top a year ago and after six months ordered two more. Mr. Elmer Wells writes: "... Our work is of an experimental nature or short run jobs on aircraft which demand high grade finishes, close tolerances and trustworthy lathe alignments ... We believe the **Ground Ways** are an important factor in producing accurate work ... Our operators find the 1200 rpm and twelve speeds to be a decided advantage, particularly in changing from steel to aluminum parts of varying sizes and diameters ... The enclosed **Quick Change Gear Box** is a good feature, it eliminates chips from clogging the gears."

Before you buy your next light duty engine lathe, examine the sound practical features of Tray-Top Cintilathes. Add them up and you'll find the "Twenty-Feature" Tray-Top Cintilathe gives you the most utility for the least investment. Swing sizes: 10", 12½", 15", and 18". 15" and 18" sizes available with gap and gap block. Write for Bulletin T-100-2. Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio.

cintilathe

TWENTY-FEATURE TRAY-TOP

MEMO

How to show your Treasurer

...that wearing out an old machine is expensive

Of course, you know that an obsolete machine, even with its low carrying charges, usually costs more to run than a new one. Your treasurer probably knows that, too; but it won't hurt to remind him that the best time to replace old machines is before they are completely amortized on the books. For, an automatic five years old is dangerously below today's Acme-Gridley production standards.

If you have seen new Acme-Gridley Automatics in action, you know that doubled production is not uncommon. Maybe we could help you prove this point for your treasurer—by placing in your hands more case histories of the actual experiences of some of our customers—down-to-earth records of dollars saved with new Acme-Gridley Automatics. Here's a typical example:

CUT THIS OUT FOR USE WHEN YOUR TREASURER WANTS PROOF

AN ACME-GRIDLEY CERTIFIED CASE STUDY

THIS IS WHAT HAPPENED

MACHINE—2" RB-6 Spindle Acme-Gridley Automatic

PART TURNED—Steel Eccentric Bushing

MACHINING TIME—17½ seconds—for 15 operations

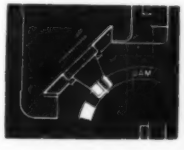
FORMER METHOD—Blank out on automatic, then, on second machine, finish eccentric shoulders, internal recess and gauge O.D.

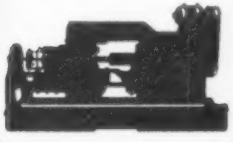
PRODUCTION INCREASE—300%

AND HERE'S ONE IMPORTANT REASON

THE ACME-GRIDLEY CROSS SLIDE is rigidly supported, low in the frame, without overhang, and has easily adjustable gibs on hardened steel ways. This design provides direct contact between the drum cam and roll, and at the center of the slide. Positive cam control is insured and excessive linkage is avoided. Moreover, there are fewer parts to wear.

Generous open space around the slides gives more chip clearance, and more efficient operating convenience, through greater accessibility to tools—all factors that insure accuracy, increased production and lower costs.





THE NATIONAL ACME COMPANY

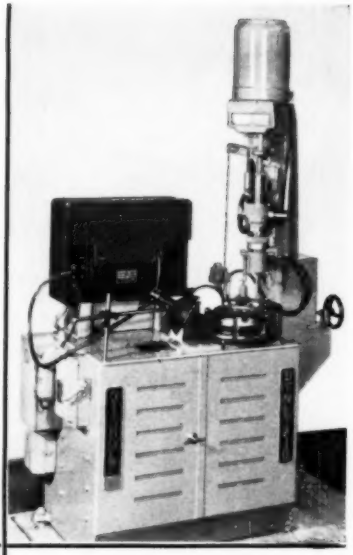
170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS built in 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

MACHINE BALANCES CLUTCH ASSEMBLIES!

Phenomenal speed and accuracy are achieved with the Gisholt machine which performs all four steps in the complete balancing operation as follows: (1) locates unbalance, (2) measures unbalance, (3) corrects unbalance, (4) checks balance. Designed especially for this work, the machine handles operations at the rate of 80 pieces per hour.

Gisholt ISV Dynetric Balancer



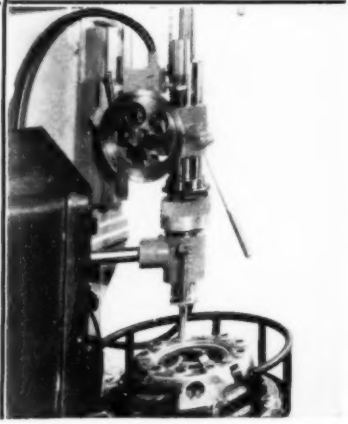
Saves handling time

With correction drill incorporated as a part of the machine, it is unnecessary to remove work piece from mounting for drilling. Handling time is cut to a minimum.

Corrections clearly indicated

Readings clearly show where and how much metal is to be removed in units of drill depth. All chips are automatically ejected so they cannot get caught in the clutch pressure springs.

Insures better service Whether it's in production or repair work, the balancing of clutch plate assemblies is of little avail unless it is done *accurately*. And here, again, the DYNETRIC principle provides the accuracy which makes Gisholt the unquestioned leader in the field of balancing. Full information on request.



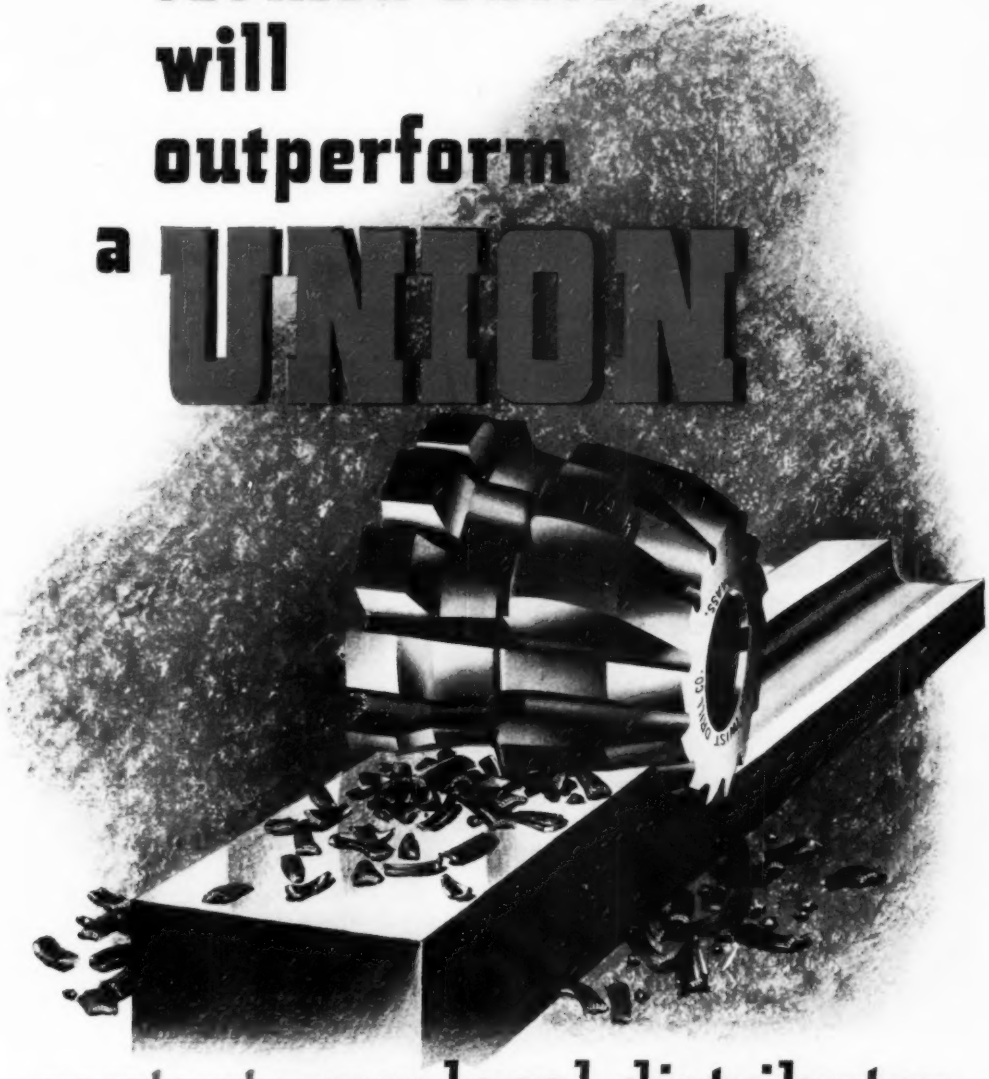
GISHOLT MACHINE COMPANY
Beautiful Madison, Wisconsin

DYNETRIC BALANCERS — GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION
"DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

TURRET LATHES • AUTOMATIC LATHES
BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

no other formed cutter will outperform a UNION



contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under the heading "Drills, Twist".

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

Van Keuren MEASURING WIRES

STANDARD EQUIPMENT...

...everywhere

Measuring the pitch diameter of a 1"-8 National Form thread gage. This method is recommended by the Bureau of Standards.

New New New

NEW CONCEPTIONS
NEW FORMULAS
NEW TABLES

for the exact measurement of multiple worms and screws of unknown profile.

The Fundamental Fact

The axis of a wire resting in a thread assumes a position tangent to the helix passed through the center of the wire and not the point of contact.

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

Set No. 20 Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires	$ 95.00
Price, Carboloy Wires	240.00

Special wires from .002" to 2.000" diameter are made to any tolerance required.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

30th YEAR

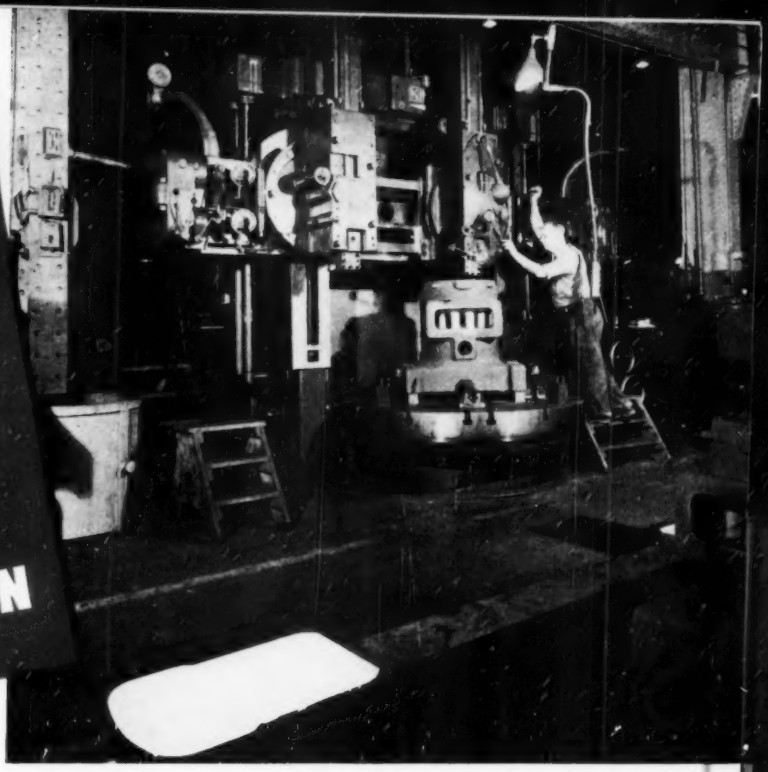
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

New Series

KING

at

COOPER-BESSEMER CORPORATION



CUTS PREVIOUS MACHINING TIME ON THIS JOB BY

4 Hours!

The 72" KING Vertical Boring & Turning Machine shown above is machining the main bore of a GMV gas engine cylinder at The Cooper-Bessemer Corporation, Mount Vernon, Ohio. The hole is 14" in diameter by 33" long, holding a tolerance of + .000" —.003", and must be straight within .001". Cooper-Bessemer officials report "We have been able to reduce our floor-to-floor time 4 hours over the old method of machining."

Cost reductions like this are typical. New-Series KING mills have the extra weight, rigidity, and power essential for maximum results from use of modern cutting tools . . . for faster, consistently accurate, more profitable work. A wider range of feeds and speeds plus simplicity of control assures high adaptability for all types of work—light or heavy, large or small.

Call in a KING Engineer. He will be glad to give you all the facts . . . to show you exactly how the versatile, powerful New-Series KING can save time and maintain high precision accuracy on your boring, turning, and facing operations.

New-Series KING Vertical Boring & Turning Machines are made in 10 sizes: Single Column—30", 36", and 42"; Double Column—52", 62", 72", 84", 100", 120", and 144". All sizes are available in a variety of head combinations, with or without side head.

American Steel Foundries

KING MACHINE TOOL DIVISION

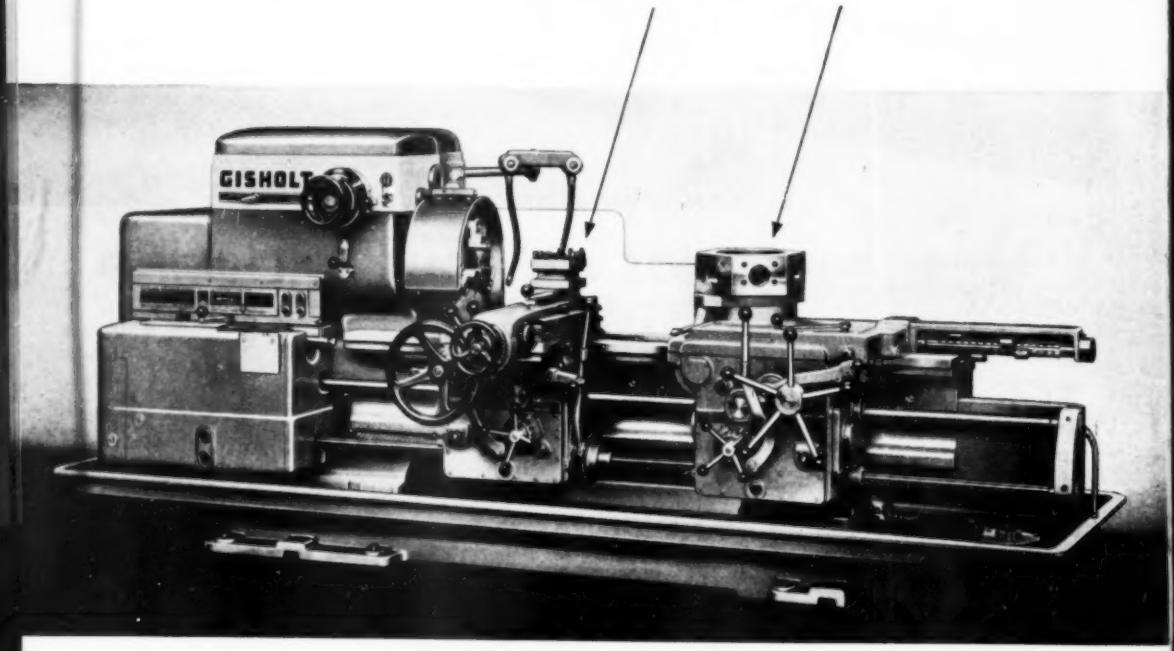
CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

RIGID TURRETS!

–for Rigid Standards of Accuracy!

It's one of the reasons why seasoned production men insist on Gisholt. The square turret tool post and hexagon turret is locked by double-beveled clamping rings which provide exceptional clamping pressure with easy hand motion. Moreover, on each indexing operation, turret faces are rigidly positioned by hardened and precision-ground locking pins to insure unfailing accuracy.



GISHOLT ACCURACY is further enhanced by a heavy unit-cast head stock and bed which insures real rigidity. Bedways of hardened steel (64-66 Rockwell C) are ground in perfect alignment with the spindle. And they are virtually wear-proof. If you want accuracy, insist on Gisholt.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

HERE'S HOW...

TO PLAN YOUR TOOLROOM HEAT TREATING DEPARTMENT

Published to assist those planning new or expanded heat treating departments. It's yours for the asking.

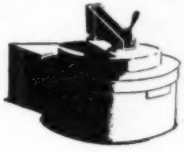
Material contained in this 24 page booklet, prepared by the Lindberg Engineering Company, is based upon years of experience in helping design hundreds of toolrooms . . . plus additional information gained from the 24-hour-a-day operating experiences of the toolroom heat treating department of the Lindberg Steel Treating Company, the world's largest.

It helps arrive at total costs in advance • Shows recommended department layouts • Tells how to select furnaces of proper size • Gives prices of auxiliary equipment such as tongs, quench tanks, straightening presses, hardness testers, work benches, etc. • Contains loose template pages of furnaces, quench tanks, etc. and graph paper . . . a few seconds of scissor work shows you how your department will look.

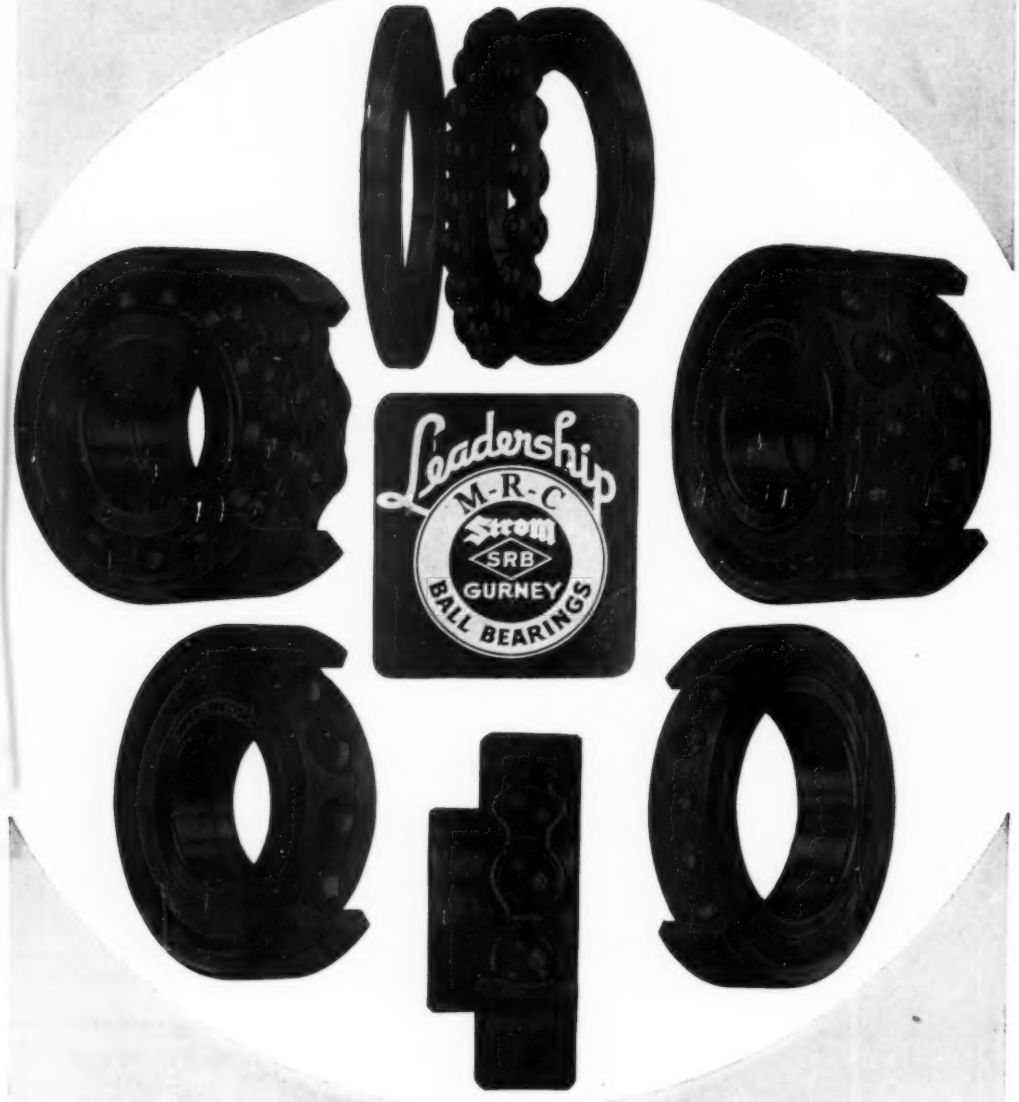
To get your copy write or call your nearest Lindberg Engineering Company office or the Lindberg home office at 2445 West Hubbard Street, Chicago 12, Illinois.

Other helps for Heat Treaters. "Heat Treating Hints"—a publication covering the practical side of heat treating with strictly "how to do it" articles. Available on request.

"Heat Treating Hints", two movies, (color and sound) bring to the screen practical articles from the printed "Heat Treating Hints". Ideal for technical associations, plant showings, schools. Write for Bookings.

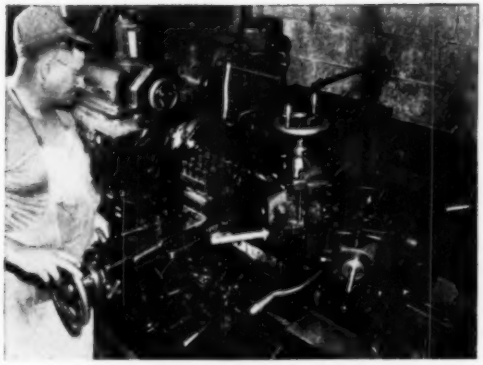
LINDBERG  FURNACES

M-R-C BALL BEARINGS

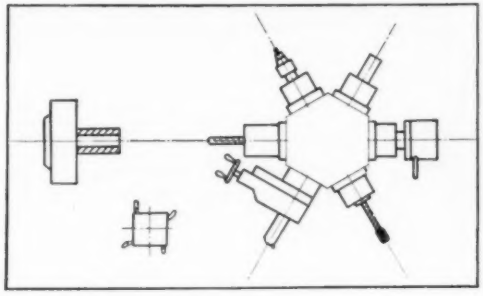


MARLIN-ROCKWELL CORPORATION

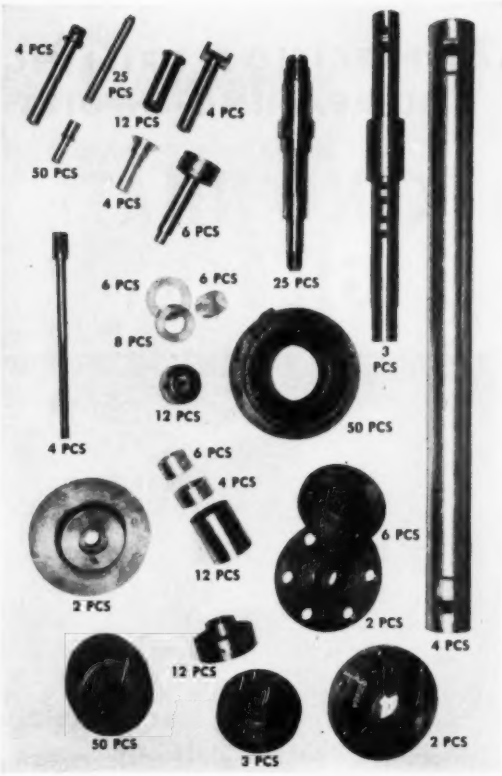
Executive Offices: JAMESTOWN, N. Y.



A special mandril being machined on a Warner & Swasey 1-A Turret Lathe. Operator R. J. Edwards says, "When you make two pieces alike and do it on a turret lathe, the setup time for the second piece is eliminated."



A Standard Tooling Setup pays off for Brace Tool and Machine Company. Standard turret lathe tools and Universal Tooling Setups can increase your production as they have in many other shops.



"Many small jobs are turned, drilled and threaded without changing tools. Very close tolerances are held; bores and OD's true with one another because of single setting," says Manager A. B. Brace. Numbers indicate pieces per lot.

WHEN PROFITS MUST COME FROM SMALL LOT JOBS

put them on a *Warner & Swasey*

The pictures above are from the Brace Tool and Machine Company of Elmira Heights, New York. They do general jobbing work and make tools for themselves and their customers. Their problem, like so many machine shops, is to give their customers a good price yet still show a profit on extremely short runs.

Brace Tool has found it pays to route very short runs—even single pieces—to their Warner & Swasey Turret Lathes. The Standard Tooling Setup usually allows the part to be made without changing any tools—just minor adjustments for size.

And in addition to faster setups, parts are machined more accurately, deliveries made more quickly when short run—as well as medium and long run—jobs are assigned to a Warner & Swasey.

Small lot production can be profitable to you, too. Call your nearest Warner & Swasey branch or write today for the 184-page book, "Turret Lathe Tools" which clearly and simply explains Universal Tooling principles.

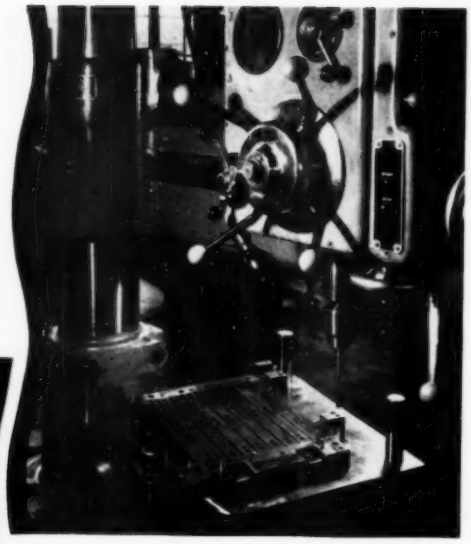
You can machine it Better, Faster, for Less... with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE AND SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

For **PRECISION DRILLING AND REAMING OF DIES**

CINCINNATI GILBERT



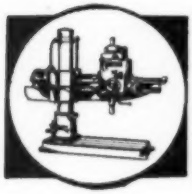
The die shown is one of a group of dies used in the manufacture of refrigerator shelves. The holes in these large sectional dies are held to close tolerances on this Cincinnati Gilbert Radial. Photos courtesy of the Rex Engineering Company, Cincinnati, Ohio.

● The flexibility of the Cincinnati Gilbert Radial is an asset on this job where there are numerous holes of various diameters to be drilled and reamed.

The heavy, rigid construction, the balanced head on arm, and full bearing support for spindle, even when fully extended provide the rigidity essential to tool and die work.

The centralized controls low on the head—the direct reading feed and speed plates with feed and speed indicator—twelve spindle speeds and six power feeds instantly available—combine to make operation simple and control easy.

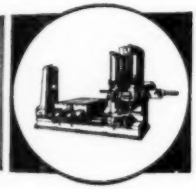
Consult a Cincinnati Gilbert Representative on your work or write for new Radial Bulletin for specific data on your work.



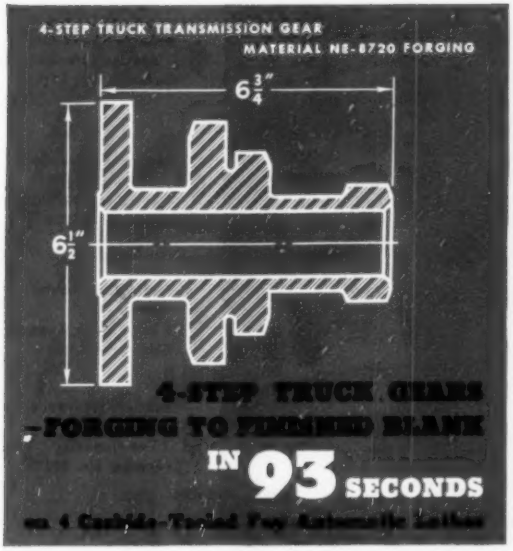
THE CINCINNATI GILBERT MACHINE TOOL CO.

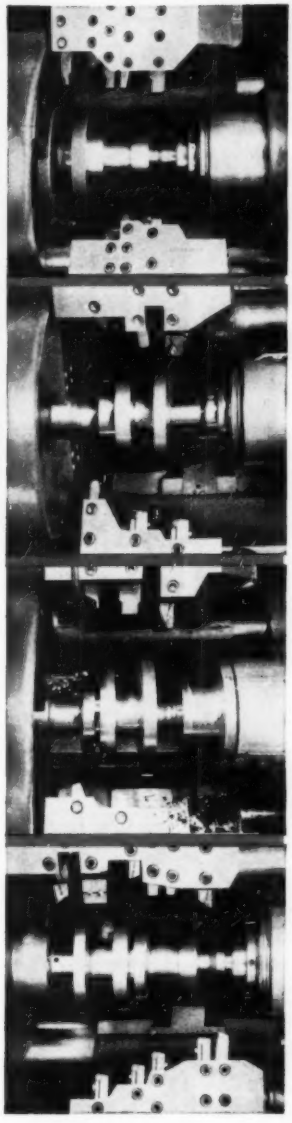
3360 BEEKMAN ST. • CINCINNATI 23, OHIO

RADIAL DRILLS . . . HORIZONTAL BORING MILLS



DO YOU COMPETE AGAINST PRODUCTION LIKE THIS ?





24 SECONDS 1st operation

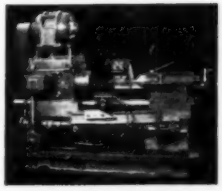
28 SECONDS 2nd operation

18 SECONDS 3rd operation

23 SECONDS 4th operation

This 4-operation gear job is a striking example of production turning on the Fay Automatic Lathe. Every tool has either a brazed or an insert-type carbide tip. Approximately 68 HP is transmitted during the first operation! Surface speeds range from 450 to 660 FPM. The blanks are completely turned, faced, formed and grooved, with every important surface held true and concentric . . . Moreover, these 4 machines are doing the work formerly done by 17!

Why not write us for more details? Let us show you why it's cheaper to own a Fay than to compete against one!



Our new 16" Fay Catalog contains many other examples of high production turning. Write to Dept. 710F for your copy.

DESIGNED To lower every turning cost. ***BUILT*** For maximum production with either carbide or high speed steel tools. ***POWERED*** To produce more chips per tool, more pieces per hour, more profit per job . . . than any automatic lathe of comparable range.

Fay Lathe Division

J&L JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Free Informative Literature

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2 Ton—30" Stroke
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Horizontal Broaching Machine
6-10 Ton—36" Stroke
Circular No. 500

Horizontal Broaching Machine
15-20 Ton—66" Stroke
Circular No. 550

Pull Up Broaching Machines
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Broaches—and Engineering Information
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Vertical Hydraulic Press
4 Ton Capacity
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. . . List the Circular numbers you would like to receive on your business card or letterhead.

What do you want to know about broaching?

Your broaching questions deserve the attention of American broach engineers. Let us draw upon a background of over thirty years experience providing industry with a complete broaching service . . . to come up with practical, profitable recommendations to handle your broaching problems. We will be glad to supply any literature you request. Better yet, send a sample part, or part print, plus hourly requirements for their engineering suggestions. Address inquiries to Department A.

AMERICAN

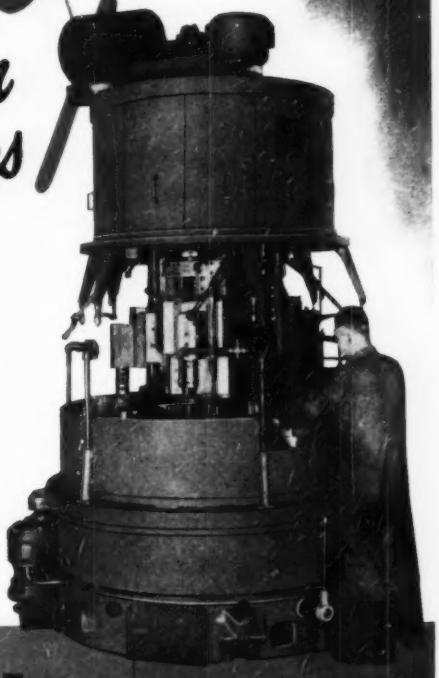
American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

Accuracy plus economy on odd shaped pieces



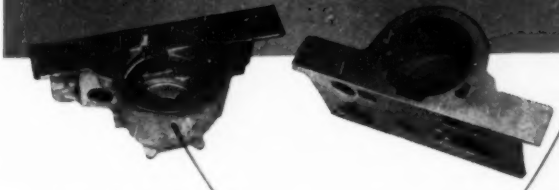
. . on the Type "D" . .

BULLARD MULT-AU-MATIC

REPETITIVE ACCURACY

of Mult-Au-Matics is well known throughout the Automotive and other fields, where these machines have proven their ability to lower manufacturing costs. Here this sixteen inch six spindle, Type "D" Mult-Au-Matic is shown at work on an odd shaped piece. This is no problem, since work is chucked in a lying down position rather than hanging it up. Many other features of Mult-Au-Matics save time and lower manufacturing costs. Write for estimate on your work as applied to these machines.

The Bullard Company, Bridgeport 2, Conn.



BULLARD

All in all . . . **Use Bullards for manufacturing Economies.**

Metalworking is investing more money in new plants and equipment than any other manufacturing industry

carries more production machinery and equipment advertising . . . by far . . . than any other magazine

. . . . . .

$1.4 billion has been earmarked by Metalworking to improve and expand its 18,000 major plants this year. And you need *American Machinist's* big, top-quality, concentrated, all-paid circulation to sell effectively in as big a market as this.

***American Machinist's* 28,000 subscribers outnumber those of any other metalworking magazine by over 9,000. *American Machinist* subscriptions to companies; corporate officials and general managers; department managers, superintendents, and engineers outnumber the *total* subscriptions of any other metalworking magazine by over 5,000. And only *American Machinist* . . . as much bigger and higher in quality as its circulation is . . . concentrates only on metalworking and on metalworking production specifically.**

Good reason, indeed, why production machinery and equipment advertisers overwhelmingly prefer *American Machinist*. Good reason, too, why these advertisers invest more advertising dollars in *American Machinist* than they invest in any other metalworking magazine. Even better reason why you should ask for all the facts on this *one* metalworking magazine which can give you the *most readers* at the *lowest cost* per contact.

THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION • McGRAW-HILL BUILDING, NEW YORK 18

American Machinist

offers you more

decision-making, production-management readers than any other metalworking publication

ARMSTRONG

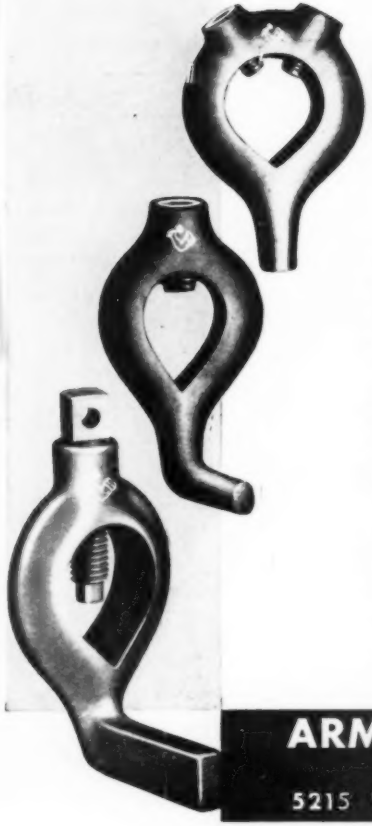
Quality TOOLS

NOT A COST, BUT AN INVESTMENT

That Pays Year After Year...

Buy ARMSTRONG TOOL HOLDERS and TOOLS for today's job and they will bring you added profits thru the years. With ARMSTRONG TOOL HOLDERS you will be permanently tooled up for whatever comes, for each is a multi-purpose tool that takes cutter-bits ground to many shapes. Each is an efficient tool, refined thru a half century of world wide use. Each has strength beyond any need, extra strength resulting from endless research and the most modern closely controlled manufacturing methods.

ARMSTRONG TOOL HOLDERS are inexpensive too, for they are produced in great numbers. They are instantly available because they are carried in stock by all leading supply houses in sizes and types for every operation on lathes, planers, slotters and shapers; for standard operations on turret lathes and screw machines. They are profitable in use because they permit the highest speeds and heaviest feeds, and "Save: All Forging, 70% Grinding and 90% High Speed Steel."



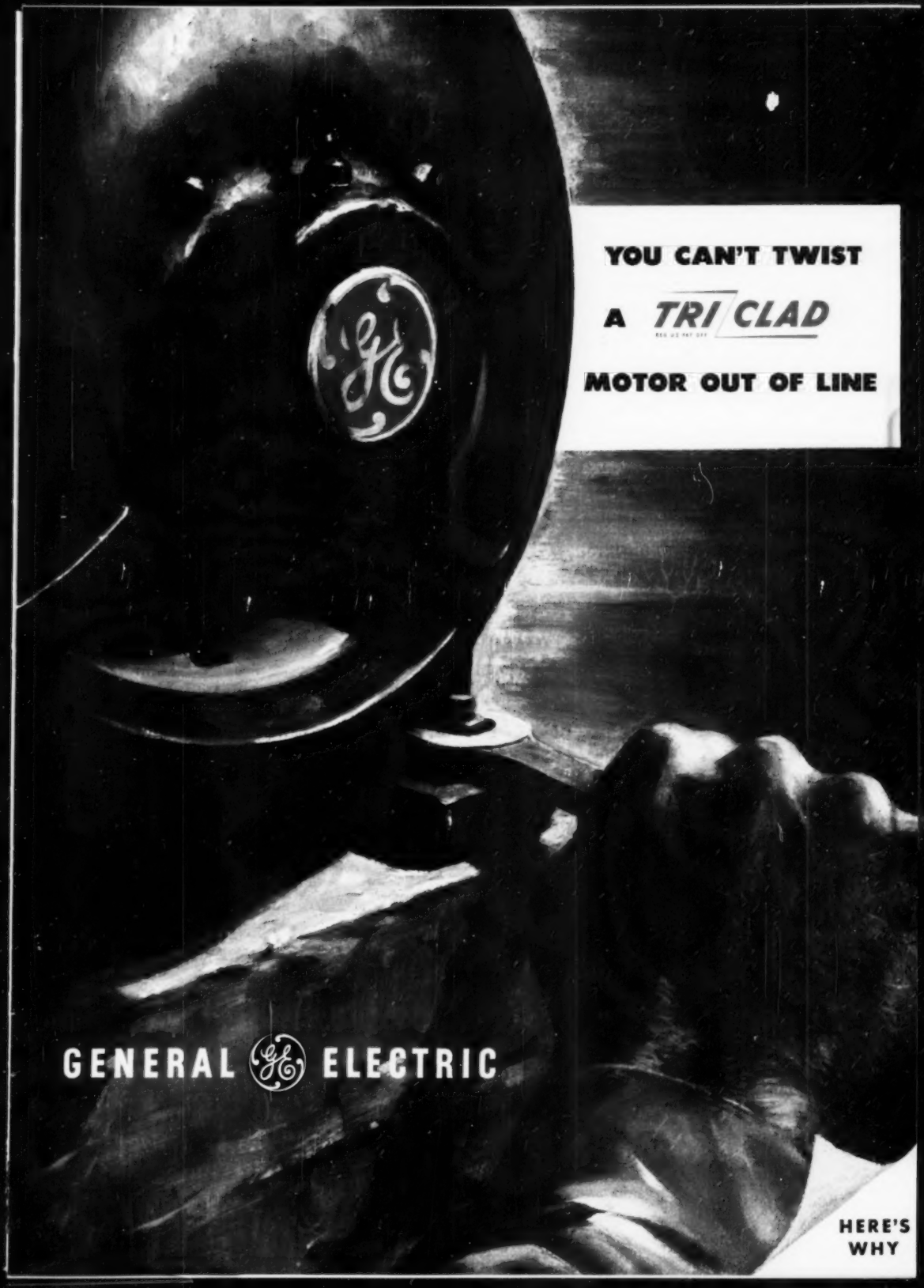
ARMSTRONG Lathe and Milling Machine Dogs are permanent tools too. They are drop-forged from special open hearth steel, are heat treated to extreme stiffness and toughness. They have alloy steel screws hardened at the tip to prevent up-setting and have double life, for hubs are made oversize to permit re-tapping.

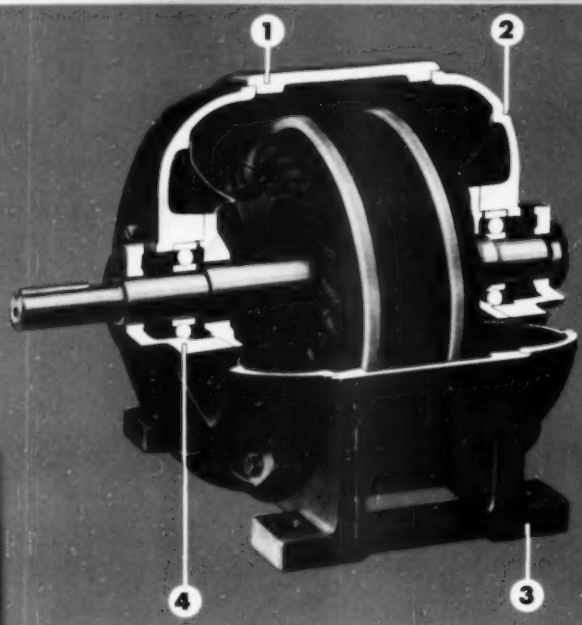
ARMSTRONG Quality pays back over and over again. *Write for new S-48 catalog.* It offers many opportunities to conserve profits.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.


YOU CAN'T TWIST
A TRI CLAD
MOTOR OUT OF LINE
GENERAL ELECTRIC
HERE'S
WHY



Look at the solidity of a Tri-Clad's thick-section cast-iron frame (1) and heavily reinforced end shields (2) . . . its heavy integrally cast feet (3). Do you wonder we say "Tri-Clad gives you structural strength and rigidity no other general purpose motor can match"? Notice, too, the completely enclosed bearings (4). A Tri-Clad motor will run safely without relubrication for years — as long as any general-purpose motor you can buy. Yet it's grease-gun easy to lubricate if you ever need to.

You can't twist a TRI CLAD motor out of line

Try as a heavy-muscled mechanic may, he can't twist a Tri-Clad motor frame when bolting it to an uneven surface. The bolt will snap before he can pull that rigid cast-iron structure out of line.

Important? It's one of the basic reasons General Electric believes cast iron to be the ideal structure for general-purpose industrial motors. Other reasons? Cast iron has unusually high resistance to rust and corrosion. It has an inherent damping action that minimizes resonance. And . . . it won't take on an injurious permanent "set" as a result of accidental blows or mechanical abuse.

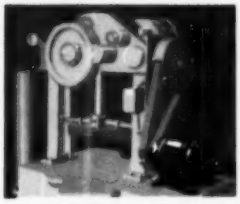
Want a motor that's been **SERVICE-PROVED** in 5 billion hours of rugged industrial use? Nearly all types and ratings are **AVAILABLE FROM STOCK.**

Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

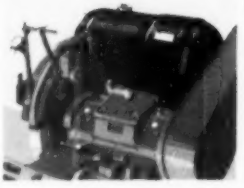
PGE-10

YOU CAN'T BEAT TRI CLAD EXTRA PROTECTION



G-E open (drippproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.

G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



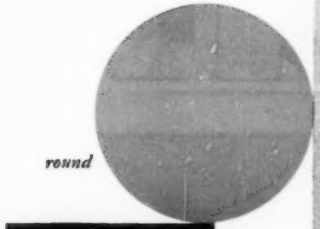
G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 75 hp.

G-E flange and face-type motors for use where the machine supports the motor, or vice versa. From 1/20 to 60 hp.

Look for this **EXTRA** on the motor you buy!

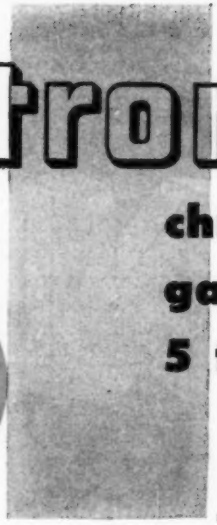
Ellstrom

chromium plated gage blocks wear 5 to 20 times longer!

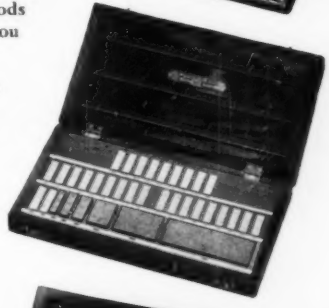


round

square



rectangular



How'd you like to make a big dent in your gage block costs? It's simple. Just specify "chromium" . . . Ellstrom chromium plated gage blocks. They're rated "tops" for all-around gage block quality . . . wear from 5 to 20 times longer than ordinary blocks, yet cost but very little more. Made of the finest materials . . . processed under precisely controlled conditions . . . and finally finished with their extra hard gaging surfaces through methods first developed and perfected by Ellstrom to give you longer wearing millionths.

Ellstrom chromium plated gage blocks are available in 12 standard sets . . . rectangular, square, or round . . . in working, inspection, or laboratory accuracies to meet every gage block requirement. Special sets, metric sets, or individual blocks are also available upon request. And every block in every Ellstrom set carries a positive guarantee of specified millionths to give you the accuracy and uniformity you need.

Ellstrom . . . *measuring in millionths for three generations.*

Do You Have the New Ellstrom Catalog? Contains complete specifications and prices on standard Ellstrom Sets . . . plus the new Ellstrom "Build-up" set, Internal Setting Gage, Inspection Service, and Trade-in Allowances. Send for your copy today!

For longer wearing millionths, specify **"Chromium"** . . . **Ellstrom** chromium plated gage blocks!

DEARBORN GAGE CO. 22035 Beech Street Dearborn, Michigan

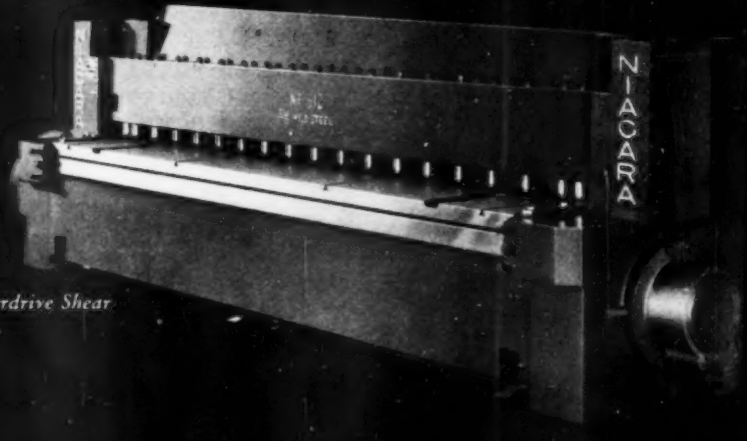
Originators of Chromium Plated Gage Blocks

FOR ADVANCED DESIGN *look into....*

NIA

Niagara Double Crank Press

Niagara Deep Throat Press



Niagara Underdrive Shear

NIAGARA MACHINE AND TOOL WORKS, BUFFALO 11, N. Y.

NIAGARA

● The modern design of Niagara Presses, Shears and other machines for plate and sheet metal work is proof of the Niagara talent and experience that is built into them. Men responsible for economical production appreciate these results of Niagara engineering,—high hourly output...convenient operation...accurate work...reliable, uninterrupted performance with minimum down time...low maintenance cost.

Write for Bulletins

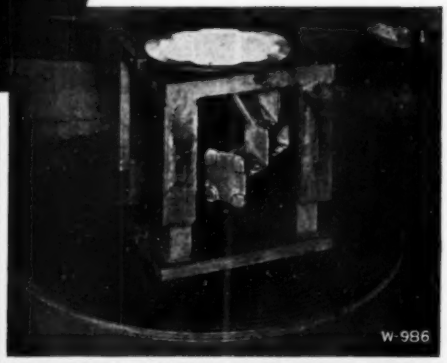
Niagara Double Crank Gap Press

America's most complete line of

PRESSES, SHEARS, TINNERS TOOLS AND MACHINES FOR PLATE AND SHEET METAL WORK

District Offices: Detroit, Cleveland, New York

DO IT THE *Easy* and *Profitable* WAY



Here are three excellent examples of large irregular pieces being finished more easily and more profitably on Blanchard Surface Grinders, by the use of specially designed, extraordinarily simple, low cost holding fixtures. If the surface to be finished can be brought to the wheel, holding fixtures can be designed to hold the work for Blanchard Grinding.

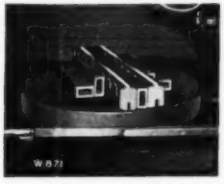
Blanchard will gladly assist you in designing such holding fixtures, or design and furnish them at low cost.

Put it on the BLANCHARD

HOW ELSE CAN YOU GET RESULTS LIKE THESE?

W-894 Cast iron chain idler brackets were ground from rough casting to commercial finish. Grinding reduced the per-piece machining time to 3/10 that necessary when a miller was used. It was put on the Blanchard.

W-957 Ten costly hours were saved finishing this milling machine universal saddle. Formerly an 11-hour hand-scraping operation, the time was slashed to 50 minutes. It was put on the Blanchard.



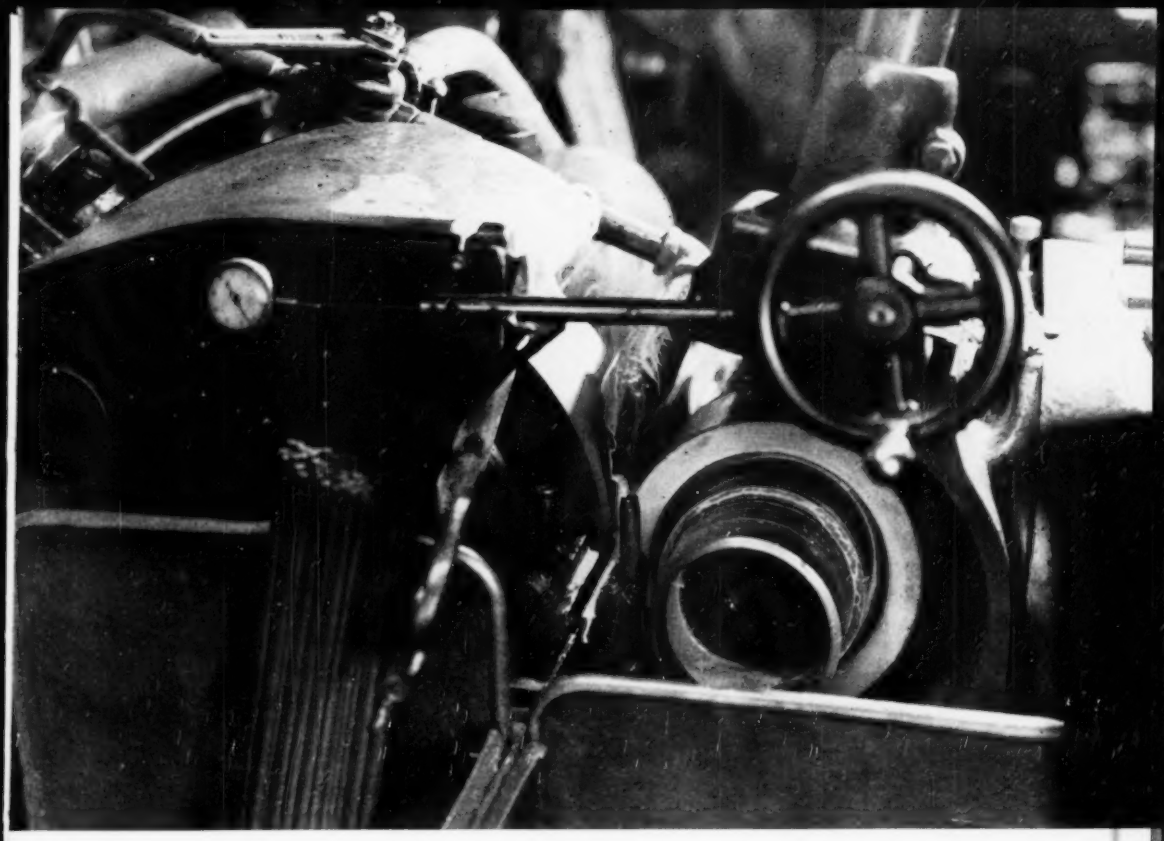
W-871 These cast iron Bearing Gibs had ¾" removed from each of the four sides. Finished edges were accurately square with sides. Production rate was tripled. They were put on a Blanchard.

Send for your free copies of "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding"

BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



Lands savings on fish pole grinding...

Using a taper grind, a midwest plant makes fishing rods from solid bar stock. Stock removal ranges up to a maximum of .052 inches.

Formerly, production averaged only 100 pieces per wheel dressing. Wheel wear was .045 inches, and wheel dressing removed an additional .025 inches.

At the suggestion of a Standard Cutting Oil Engineer, Stanicool HD Soluble Oil was introduced on this job. Production jumped to 500 pieces per wheel dressing. Wheel wear between dressings was eliminated.

That's *really* landing savings—five times as many pieces, one third as much wheel wear! Fewer dressings and less wear on wheels cut tool costs 20%.

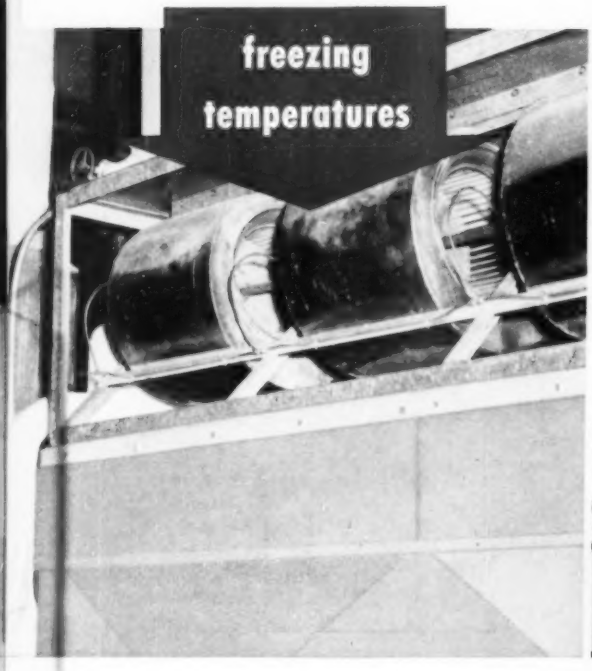
A superior coolant, Stanicool HD Soluble Oil also meets the requirements in many cutting operations. To replace costly cutting fluids or to improve tool life and production on your machining operations, try "Stanicool HD."

Stanicool HD Soluble Oil

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Cutting Oil Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD

Here's ONE grease that withstands



Bearings in electric motors and fan shafts in a midwest cold storage plant are exposed to storage-room temperatures of 32° down to −10° F. The grease, applied by pressure gun, has to flow through ¼" copper tubing to reach the bearings. At the low temperatures, conventional greases continuously gave application and lubrication troubles.

The problem was solved by Stanolith. Despite freezing temperatures, this unique product flowed readily through the tubing and provided safe lubrication for the bearings.

Bearings in the can-washing equipment shown above are subjected to the severe washing action of water at near-boiling temperatures of 180° to 200° F. This combination of heat and water proved too severe for conventional greases and posed a lubrication problem in this midwest plant.

At the suggestion of a Standard Oil Lubrication Engineer, the job was given to Stanolith Grease, a lithium soap product with the unique ability to withstand both heat and water.

In six months' service, Stanolith has provided trouble-free lubrication for the bearings. Moreover, Stanolith has been used successfully for lubrication of bearings in the plant's electric motors and conveyor systems. Its versatility has eliminated the cost and trouble of stocking special lubricants.

Stanolith Grease

If heat, water, or low temperatures interfere with proper lubrication in your plant, try Stanolith Grease. A Standard Oil Lubrication Engineer will be glad to give you more information about this versatile product.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD

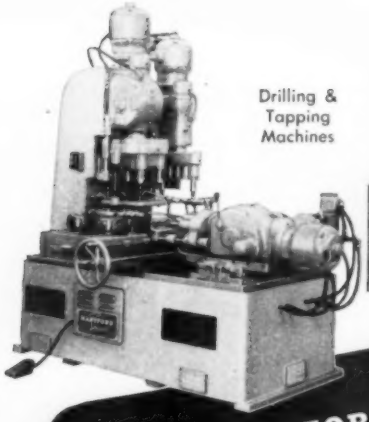
INDESTRUCTIBLE... HAND DETACHABLE

THE CONTINENTAL DRIVE IS STRICTLY HAND DETACHABLE... REGARDLESS OF HOW SEVERE THE OPERATION HAS BEEN
With an ever-widening range of practical uses, the Continental Counterbore is a favorite standard cutting tool in all types and sizes of machine shops. Of rigid and simple construction, with time saving features, it has long been outstanding in American industry. There's a reason: Note in illustration above the Continental indestructible drive. It is composed of two driving lugs formed on the cutter shank, with two corresponding abutments on the inside of the holder. There is an aligning bearing above and below the driving lugs that brings the cutter and holder concentric, and prevents the cutter from being forced out of alignment. The cutter and holder are engaged and disengaged by revolving the cutter a quarter turn by hand. No tools or equipment are necessary . . . no drift pin required.

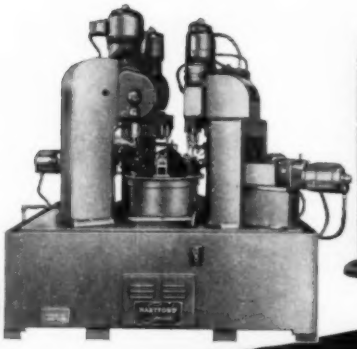
Continental holders and cutters are available individually or in standard tool room sets. Send for Catalog No. D27161.

49-29

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



Drilling & Tapping Machines



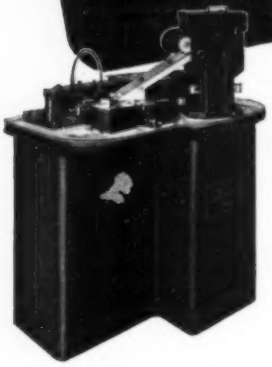
Swaging Machines

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONNECTICUT

now producing the standard line of

DRILLING & TAPPING MACHINERY
SWAGING MACHINES

formerly manufactured by
LANGELIER MFG. CO.
Cranston, R.I.



in addition to our

Automatic THREAD ROLLERS
DIE POLISHING MACHINES

and complete line of special machinery built to specification

We also manufacture exclusively these famous shop aids

"Super-Spacers"

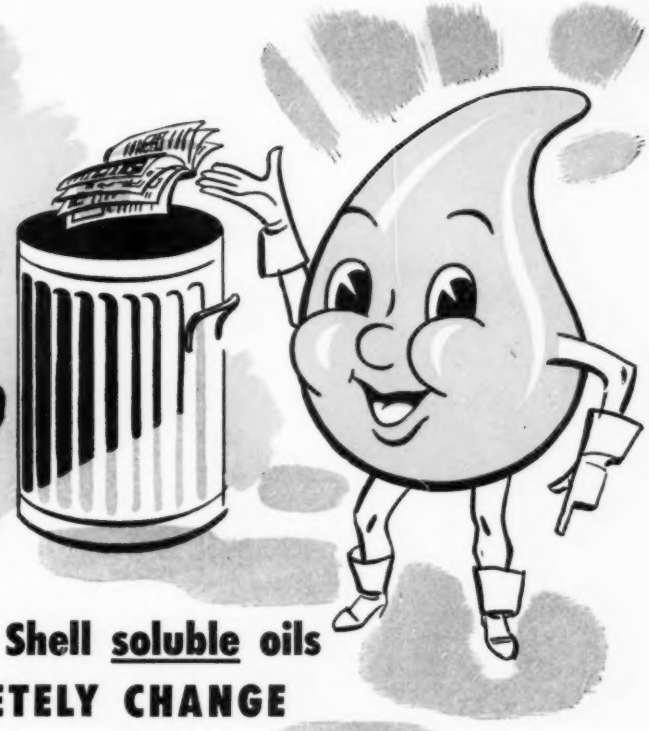
"Four-Point" Milling Vises

"V-Block" Milling Fixtures

HARTFORD *Special*

...the standard for special machinery

"Throw away the book!"



Here are the new Shell soluble oils that can COMPLETELY CHANGE your cutting fluid practice

You have experienced the economy of soluble oils on light machining and drilling jobs . . . Haven't you often wished that this same economy could be extended to your tougher jobs, which have always required expensive conventional cutting oils?

Shell has developed *soluble* oils that replace conventional cutting oils on many heavy duty jobs . . . *even with emulsions as high as 10 to 1.*

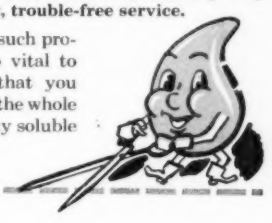
Here are some actual cases:

1. On gun receivers, an expensive cutting oil had been used straight in the milling and profiling operations. One part of a Shell heavy duty soluble oil and 10 parts of water took over the job . . . performed as well as the cutting oil in every respect.

2. In deep drilling, an emulsion of one part of a Shell heavy duty soluble oil in 5 parts of water successfully replaced an oil type cutting fluid . . . at 1/5th the cost!

3. With Bullard Multimatics, on heavy duty turning of steel forgings, a 4 to 1 emulsion of Shell heavy duty soluble oil gave efficient, trouble-free service.

Don't you agree that such production savings are too vital to pass by? We suggest that you mail the coupon now for the whole story on Shell heavy duty soluble oils.



SHELL®

Shell Oil Company, Incorporated
52 West 50th Street, New York 20, N. Y.; or
100 Bush Street, San Francisco 6, California

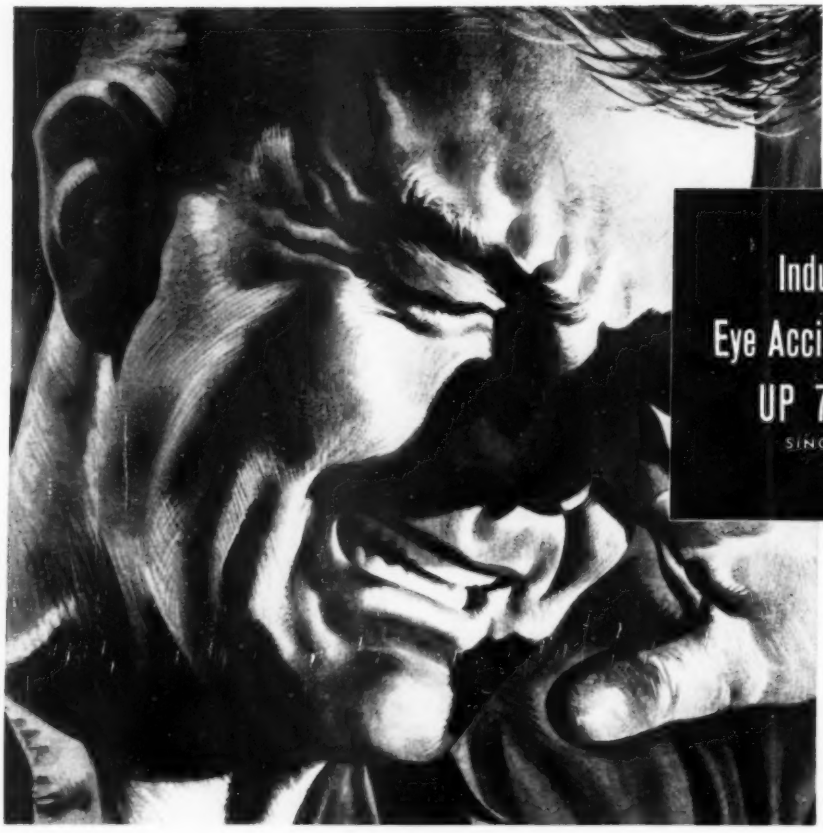
Gentlemen: Please furnish all available information on the new heavy duty soluble oils.

Name_____

Company_____

Address_____

SHELL METAL WORKING OILS



This High Cost...

without a Friend among Management or Workers—

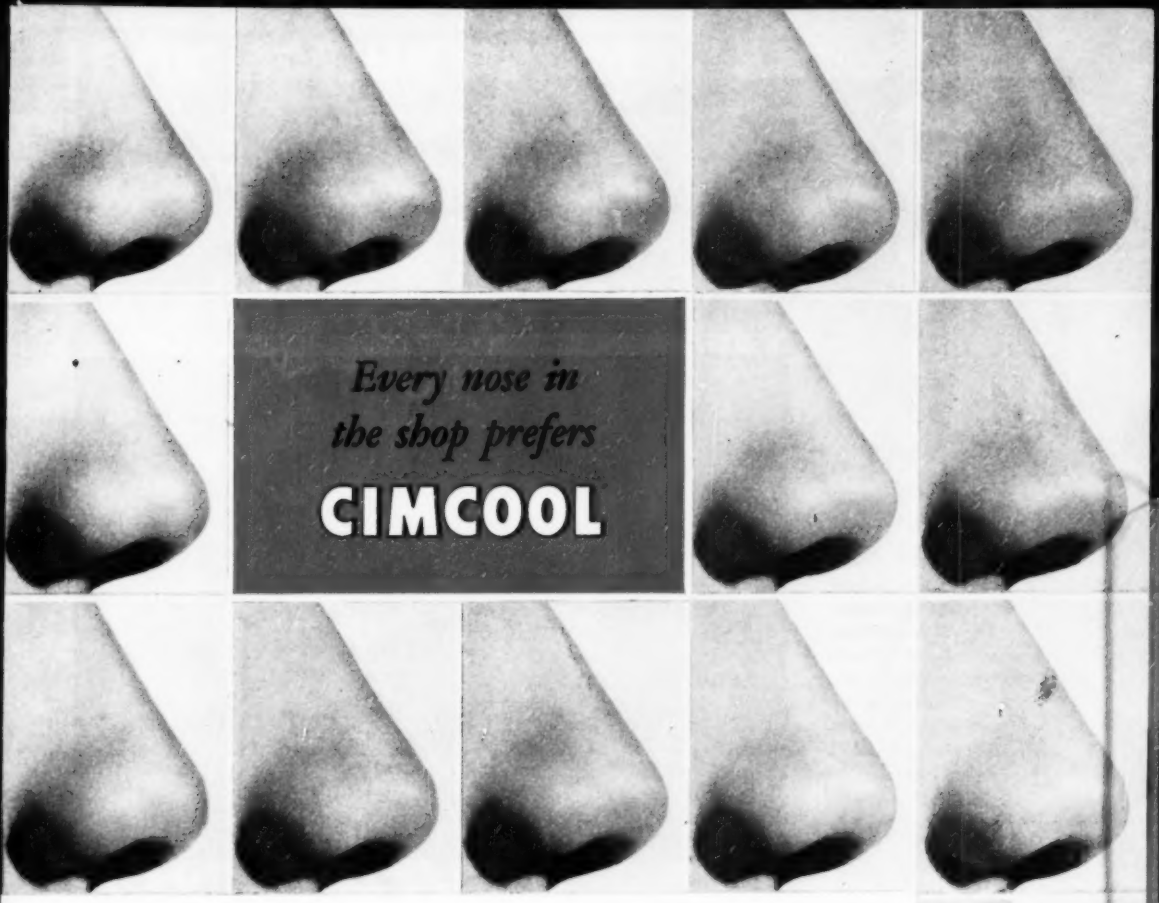
Can Be Cut Immediately!

INDUSTRIAL eye accidents occur at the rate of two a minute. They average more than $85 per employed worker per year in cost. In the campaign to maintain production, wages and profits at rewarding levels, an American Optical Company eye protection program that can prevent 98% of these accidents merits serious consideration. (One large company saved over $44,000 annually with an AO program.)

Your AO Safety Products Representative has complete case histories showing *how much* the AO program does and *how little* it costs! Ask him to call.

American Optical
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities



Every nose in the shop prefers

CIMCOOL

WHY? Because Cimcool—a revolutionary cutting fluid—virtually eliminates rancidity and foul odors. Even *in the hottest weather.*

Cimcool is a *chemical emulsion* that has no objectionable odor of its own. And it can't burn, can't smoke.

But that's not the only difference between Cimcool and old-fashioned cutting fluids. Operators also like Cimcool because it's clean to work with, doesn't soil hands or clothes and contains no skin irritants. Leaves no hazardous slippery film on the hands, machine, work or floor. And Cimcool cools so fast that tools and chips actually stay cool to the touch. You'll find your operators like their jobs better when Cimcool is on the job. And *you'll* get better production.

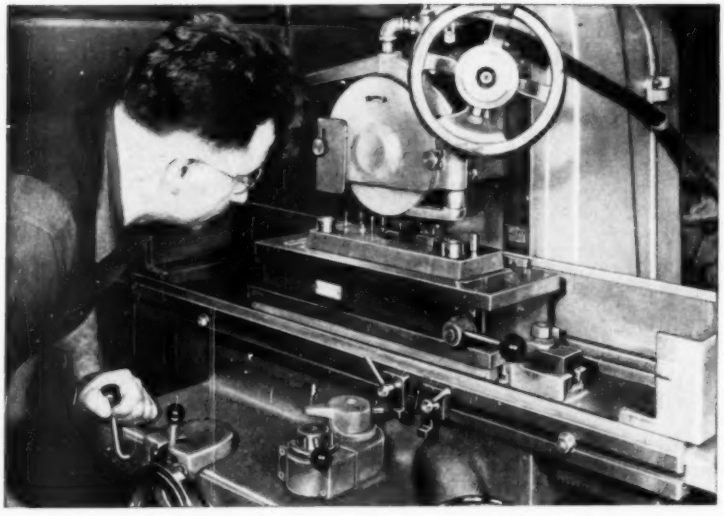
Write for free booklet, "CIMCOOL Gives the Answers". Address, Sales Manager CIMCOOL Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

°TRADE MARK REG. U.S. PAT. OFF.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS

Enthusiastic Customers do our BEST advertising



Tinnerman Products, Inc. of Cleveland, Ohio, manufacturers of Speed Nuts, use a No. 25 Grand Rapids Hydraulic Feed Surface Grinder in their toolroom. Here their Model 25 is shown grinding a combination die.

You will appreciate the micro-inch finish produced at production speeds on Grand Rapids Grinders. All Grand Rapids Hydraulic Feed Surface Grinders have these outstanding features:

1. **One-piece column and base casting for vibrationless rigidity**
2. **Precision ball-bearing spindle which is greased for life**
3. **Bijur one-shot lubrication system eliminating hand oiling**
4. **Patented vertical movement of wheel head for quick, accurate adjustments**
5. **Portable coolant tank for ease of coolant replacement**
6. **Vane type hydraulic pump for fast longitudinal table travel**

to serve you—

Your inquiry concerning your specific grinding needs will receive prompt attention. Grand Rapids Grinders include: Hydraulic Feed Surface Grinders, Universal Cutter and Tool Grinders, Hand Feed Surface Grinders, Drill Grinders, Tap Grinders, and Combination Tap and Drill Grinders.

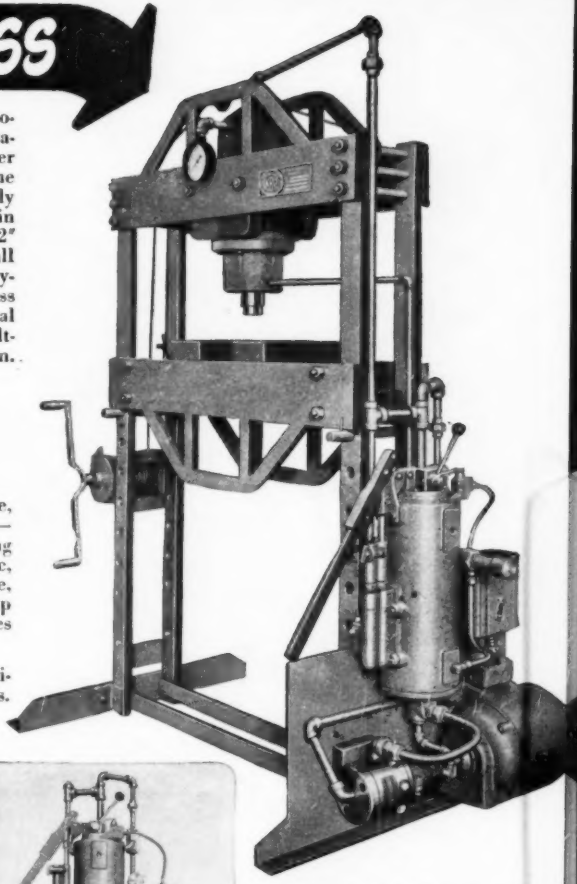
GRAND RAPIDS GRINDERS

GALLMEYER & LIVINGSTON COMPANY

330 Straight, S. W., Grand Rapids 4, Mich.

LOOK AT THIS PRESS

It's designed to provide industry with low-cost, high production units that are highly flexible in design and operation . . . relieving heavier presses of short runs and lighter work. Presses are practically fool-proof in operation. Frame is extremely rugged. Fingertip controls are conveniently located at hand level. Available for immediate delivery, in standard width (between uprights) of 24″—31″—36″—42″ respectively. Available in special width up to 72″ at small additional cost. Movable bed plates. Pumping unit has by-pass relief valve which can be set at any pressure up to press capacity. Presses available for either vertical or horizontal operation. *All Standard* presses equipped with 2-speed built-in hand pumps for more sensitive and versatile operation.



READ THESE "SPECS":

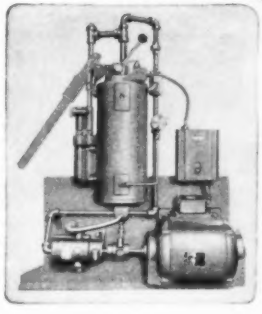
CYLINDERS: *Standard Models* furnished with 6" bore, 7½" stroke—spring return type; also 5" bore, 7½" stroke—spring return type. Above presses are *standard.* Following can be furnished at additional cost: Double Acting, 6" bore, 7" stroke; 6" bore, 11" stroke; 5" bore, 7" stroke; 5" bore, 11" stroke. Special long stroke cylinders also available, up to 48" in length, for incorporation in suitable press frames of our make.

PUMPING UNITS: These units can be supplied in various volumes and pressures, in a total of 13 combinations.

Presses include V blocks, Gauge, Motor Controls, Pressure Regulator, etc., complete and ready to attach to electrical source.

CHECK THESE USES:

There are so many everyday production uses for these versatile KRW Hydraulic Presses that we have lost count. Here are a few of the more obvious . . . blanking, forming, bending, broaching, straightening, stamping, embossing, numbering, upsetting, laminating, pressing and hot or cold forging. KRW Engineers are daily developing other uses. If you have only a vague idea of how these presses might be used in your plant, let us have it in a rough form. We'll do the rest.



MODERNIZE AND MOTORIZE YOUR PRESENT KRW PRESS with one of these compact motor drive units. They come complete ready to connect to your press. Require very little extra floor space. Write for conversion unit prices, giving the capacity and serial number of your press.

BEAT THESE PRICES*:

Depending upon capacity of pumping equipment, prices of Standard model motor driven hydraulic presses are as follows, F. O. B. Factory: 25-ton press from $727.00 to $992.00. 50-ton press from $806.00 to $1058.00. 60-ton press from $1070.50 to $1135.00. 75-ton press from $1198.00 to $1258.00. All motors in the above units are 220/440 volt, 3 phase, 60 cycle. Any change in motor specifications is extra. **Subject to change without notice.*

MAIL THIS COUPON

It will bring you all the money-saving facts about these low cost, high production hydraulic presses. Now is the time to get ready for the highly competitive days ahead.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y.

Please send me complete information on KRW Motor Driven Presses as follows:

☐ 25-ton ☐ 50-ton ☐ 60-ton ☐ 75-ton presses

☐ motor drive conversion unit ☐ Press Cap.

Serial No. .....

Name .....

Address .....

City and Zone ..... *State* .....

K·R·WILSON

215 MAIN ST. · BUFFALO 3, N. Y.

. . . to suit your every need!

Do you make rivets . . . other cold-headed products? Do you need quality copper-alloy wire to be headed, extruded, drilled, or redrawn? Do you need wire of a certain degree of hardness, malleability?

Have you read the headline of this ad? Then you know the answer!

Come to Chase. Chase service, Chase quality . . . is just what you've been looking for. The word quality here means many things . . . freedom from physical defects . . . uniformity of surface texture and color . . . accuracy of dimensions . . . precise adjustment of temper and control of grain size.

Come to the nation's headquarters for brass and copper. Call your nearest Chase Warehouse or Service Office today!

Chase

the Nation's Headquarters for
BRASS & COPPER

WATERBURY 20 CONNECTICUT

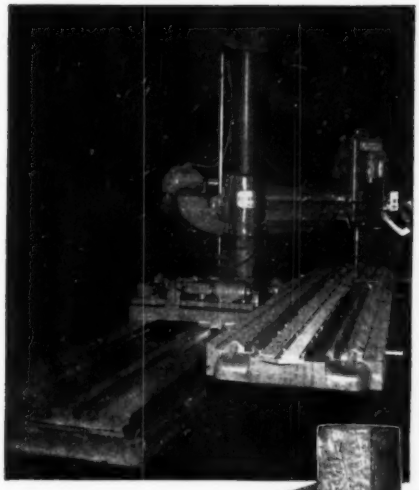
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

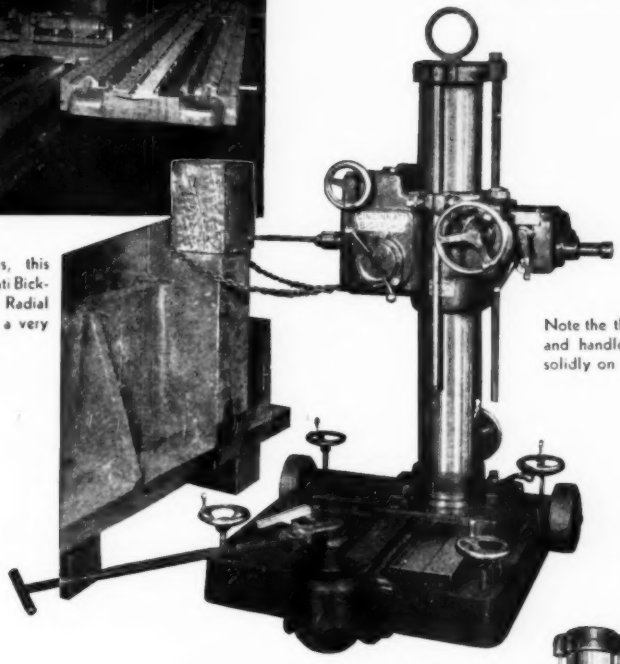
ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS† DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE† MINNEAPOLIS† NEWARK† NEW ORLEANS† NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE† ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE† WATERBURY (†Sales Office Only)

Profitable Applications

of Traveling BICKFORD Radial Drills

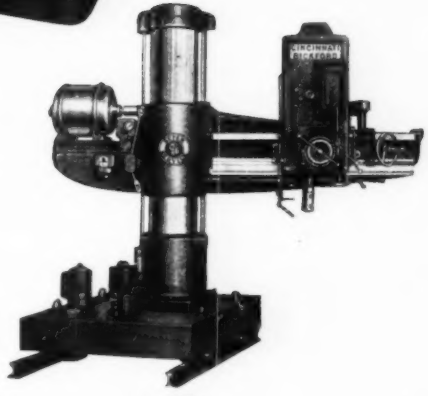


Mounted on ways, this sliding base Cincinnati Bickford Super Service Radial Drill is working on a very long casting.



Note the three-wheel base is easily moved and handled—in operation the base rests solidly on 4 leveling screws.

Moved by power, this track mounted Cincinnati Bickford Super Service Radial Drill has an unusually heavy base, rolling on hardened steel wheels.



When it is an advantage to move the drill to the work, Cincinnati Bickford Super Service Radial Drills, in various sizes and styles, are equipped for this service.

The "Portable Horizontal" is an inexpensive, 100% mobile machine, and offers great advantages on work within its range.

Powered with a 1½ horsepower motor, the base is equipped with leveling screws and built-in levels. Very handy; is easily rolled along the floor or moved by crane.

Large, cumbersome castings are being profitably handled by Cincinnati Bickford Super Service Radial Drills.

Write for Bulletin H-R, on the Horizontal Radial, or let us consult with you on your drilling problems on large castings.

See our Condensed Catalog in Sweet's File.

Equal Efficiency of Every Unit Makes the Balanced Machine.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

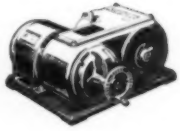
"Looks like Bascom has fallen in love with that new, Reeves-equipped machine"

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



Give your workers machines that are equipped with REEVES Speed Control and they'll give you a better, more profitable day's work. With the turn of a wheel or touch of a button, each individual operator can obtain—instantly and accurately—the precise machine speed at which he can turn out the *most* work and the *best* work commensurate with his own, individual ability. Make sure the new machines you buy are REEVES-equipped. Install REEVES Speed Control on machines already in service. Your employees will appreciate it . . . and you will appreciate it when you see the resultant improvement in quantity, quality and cost of production. Write for Catalog No. A21-450A.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

SPOT NEWS OF METALWORKING

Important savings in deep drawing of steel are expected from dry lubricants used to precoat sheets or coil stock. Precoating saves labor at presses in applying lubricants. Also, the dry material does not pick up dirt which wears dies, drippings are avoided, and cleaning with hot water avoids expensive chemical treatments. Ford, Pontiac and Briggs already are using the dry lubricant. Other automobile companies are expected to follow.

A 100% die-cast engine is used in new model developed by prominent motorcycle maker. Structural parts are induction-brazed. Weight has been cut from 500-600 lb. to 250-300 lb.

Forgings made of titanium are being developed by important metalworking company in its laboratory in New England. Main purpose is for use in airplanes.

Bell sweptwing stainless steel X-2 research plane, powered by Curtiss-Wright rocket engine, is scheduled to make its initial flights next January. It will explore the transonic speed range between Mach .9 and Mach 2.

Fiat plans to spend $15 million next year for U.S. machine tools. Purpose: (1) to push output of new Fiat car models, (2) to reduce production costs by modernizing its shops. This sum will be on top of $15 million being spent this year for machine tools and dies, jigs and fixtures (story on page 129).

NLRB has refused to order bargaining elections requested by unions at Tower Tool & Die Co. and Screw Machine Products Co. in Denver, Colo., on basis that they sell 95% of their products within their own State. Board said: "effect of business on interstate commerce too remote."

Minimum wages which industry must pay for work on government contracts of more than $10,000 are being raised by Secretary of Labor Tobin under Walsh-Healey Act. Minimums of $1.23, $1.19 and $1.08½ per hr have been fixed for iron and steel industry in different parts of country. Labor unions have asked raise from 50c. to $1.15 in aircraft industry, with Secretary Tobin indicating that minimum should be at least 95c.

Phantom orders for gages are being prepared by National Security Resources Board and are likely to be distributed soon. Such orders already have been placed for machine tools and cutting tools.

A 40% boost in output of Swedish machine shop products is planned by Swedish government by 1952. Success will depend upon ability to secure raw and semi-finished materials and to bring down production costs to competitive level.

NSRB has awarded $200,000 contract to Bureau of Labor Statistics for new study of inter-industry relationships which will enable NSRB in future emergency to work out quickly a national production program making most efficient use of U.S. resources. Input-output technique of economic analysis and planning will be used and at least 120 groupings will be made.

Propeller-driven fighter planes are back in the Air Force's plans. Aim is to rebuild Tactical Air Force for support of ground troops. Such planes are maneuverable, suited for low-level strafing and bombing.

Austenitic cast ferrous alloy containing 19.50% chromium and 9% nickel has been developed by Lebanon Steel Foundry for requirements of sub-zero service at operating temperatures as low as —423 deg. F.

Gaging Metalworking

After allowance is made for widespread plant shutdowns for vacations, metalworking operations have stayed fairly high and steady. The August rate probably will be close to the July level. But July was lower than June.

► Inventories are being worked down to such a point that the worst of the liquidation of materials appears to be over. Further shrinkage is due, but will not be as violent as in the last three months.

► Industrial machinery orders are down. July and August promise to be the lowest spot in years for machinery manufacturers. Hopes now are pinned on an influx of business this fall. Inquiries are sufficiently good to support these hopes.

Detroit Is Active Spot

Detroit is without doubt the most active production spot in the country. Automobile assemblies lately have been little short of phenomenal; and August looks good, too. This year as a whole will be fully up to the expectations of the industry and will be better than many automobile men had anticipated. Just when things began to lag, car sales spurted and the industry got its "second wind."

The automobile industry has contributed mightily to the support of metalworking during the summer season. The final four months of the year promise well, though a lower rate seems in order. New 1950 models, such as Buick and Studebaker are introducing, will aid in stimulating sales.

Tractor Makers Doing Well

Tractor and earth-moving machinery makers still are doing well and should continue to operate close to full capacity for some weeks. Televison demand has slackened somewhat seasonally, but is expected to recover in the early fall.

► Diesel locomotive builders are busy filling a comfortable backlog of orders. New business, however, has been lean. General Motors has just announced its intention of establishing a diesel-locomotive plant at London, Ont. Railroad car builders are faced by a disheartening situation. Their plants are fairly well engaged cleaning up orders on hand, but new freight-car sales have been almost non-existent.

► June volume of new orders in the gearing industry decreased 8.9% from the May figure. The index of the American Gear Manufacturers' Association was 227.8 for that month (1935 to 1939 equals 100).

Forging People Have Good Backlog

The forging industry has about five-months' worth of business at hand. Its bookings during May and June exceeded those earlier in the year, but July showed a seasonal drop which was not too serious.

► Press builders, mechanical and hydraulic, say that new orders have declined, but prospects are good. Improvement in the electric power supply by additional new generating facilities is aiding sale of electric industrial heating furnaces.

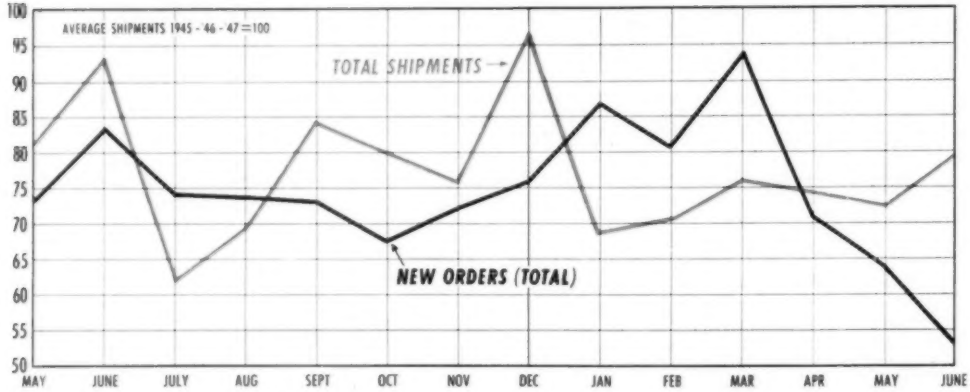
Machine Tool Orders Lag

Machine tool demand continues in a midsummer lull. Both domestic and foreign sales have been off recently. There is little prospect of improvement until September.

► The delay in Congress in authorizing new ECA appropriations will mean postponement of fresh orders for machine tools from western Europe. ECA is trying to encourage prospective European buyers and U.S. builders to proceed with orders on an informal basis pending the granting of new funds by Congress, but the latter are disinclined to take business on such a basis. Their experience of getting caught with $10 million of machine tools which could not be delivered to Czechoslovakia and other eastern European nations is still vivid in their minds. They do not wish to repeat that experience, this time in western Europe.

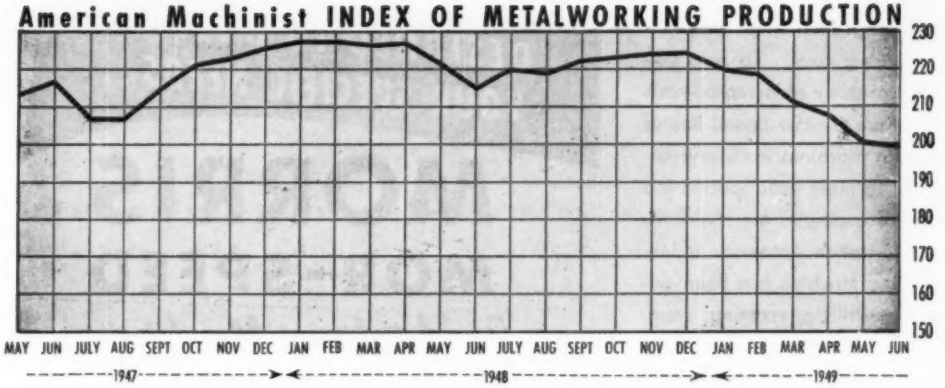
► There is good reason to believe that slashes in ECA funds will not seriously cut down purchases of machine tools by ECA countries. In general, the orders placed the past fiscal year have been for the kind of machine tools, largely special and semi-special, which western European users can obtain only in the United States.

MACHINE TOOL SHIPMENTS RISE AS NEW ORDERS DROP



Data: NMTBA
(p—Preliminary figure)

	JAN	FEB	MAR	APR	MAY	JUNE
New Orders (Total)	87.0	80.9	93.5	70.1	63.7	p53.5
Foreign Orders (Included in Total)	21.9	26.5	22.3	23.1	15.9	p15.8
Shipments (Total)	68.8	70.3	75.8	74.9	72.8	p79.0



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May 1949 (revised) 200	212	194	202	288	136
June 1948..... 216	250	227	217	282	148

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

► Final figures for June revealed an astonishing dip in new orders to 53.5 on the index of the National Machine Tool Builders' Association. That is by far the lowest mark hit since the index was set up (average month for 1945, 1946 and 1947 is taken as 100). The ratio of export orders to the total has declined sharply from about 26% to 16%. It is believed that this ratio will rise later in the year.

Steel Continues Steady

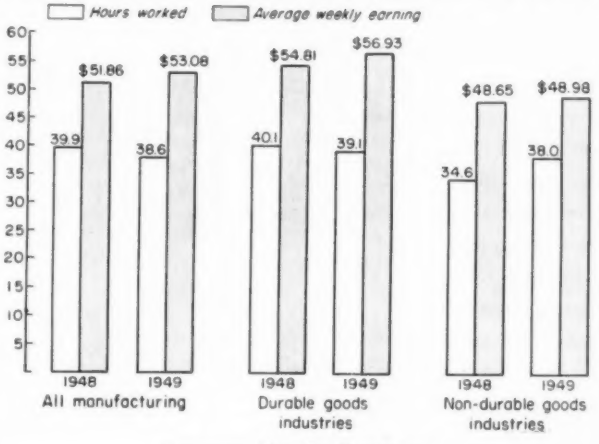
The steel operating rate is likely to remain in the 70-80% bracket the next few weeks. Possibility of a steel strike after the government board reports its recommendations for a labor settlement does not seem to disturb steel users, who have not increased their orders appreciably.

► Buying of non-ferrous metals has been only moderate. Zinc prices have advanced a bit (½¢ a lb) and interest accordingly picked up slightly. Copper continues in relatively light demand. Lead deliveries in July exceeded the June figure; and June was the best month in the first half of 1949.

Profits On Down Grade

Profits of fabricated metal and machine companies are on the downgrade. They were about 17% off in the first three months of this year compared with the October-December period and were 16% down from the corresponding period a year ago. Sales tumbled 10% from the preceding quarter and half that amount from the first quarter of 1948. The smaller firms made out better than the big corporations, a reversal of the trend up to then.

Hours Worked in '49 Slightly Less Than in '48



Average Hourly Earnings

	May 1948	May 1949
Durable Goods Industries	1.36	1.45
Iron and Steel and Their Products	1.42	1.52
Electrical Machinery	1.35	1.45
Machinery (except electrical)	1.44	1.51
Automobiles	1.54	1.70
Transportation Equipment (other than autos)	1.48	1.57
Non-Ferrous Metals and Products	1.35	1.43

Source: U.S. Dept. of Commerce

DESIGNED TO MEET YOUR SPECIFIC NEEDS . . .

MORRIS MOR-SPEED *Production Machines*

● In a great many instances greater production is the only answer to rising costs. To help you meet this problem of increased costs Morris offers the Mor-Speed line of production machines each one engineered to meet your specific job needs. For example, the Hydraulic Vertical 6-station Automatic Indexing Drilling Machine has been designed for drilling, reaming, counterboring and spotfacing operations on housings for automobile oil pumps.

The machine is equipped with four vertical drill spindles—two vertical reaming spindles — one vertical counterboring spindle—one vertical spotfacing spindle and three horizontal drill spindles. Six hand clamp holding fixtures enable operator to load and unload machine easily and quickly at each indexing of machine.

If your work calls for multiple operations on high production jobs consult Morris. Morris has available the engineering skill — manufacturing experience and facilities to help you obtain greater production and lower costs from equipment designed to meet your specific needs.

Builders of MOR-SPEED Line

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Our Most Important New Resource

Remember predictions that pent-up demand for engineering graduates could not be completely satisfied by our colleges until the mid-1950's?

Well, here we are in 1949. Thousands of engineering students were awarded diplomas in June. A large percentage of them have not been able to get jobs.

For the first time in a decade, graduates going out from our educational institutions—colleges, high schools, trade schools—are finding it hard to earn a living. Job picking is slim.

This unfortunate situation imposes upon every metalworking company a serious obligation. Though it may be able to employ only a few new people or none at all, it should do everything possible to see that these youngsters are given a fair and considerate hearing.

Management should take pains to prevent any of these young people from being "brushed off." The day of the closed bleak-looking employment gate and of the brusk answer of "no jobs" is over.

Instead of the "cold" treatment, management can grant to each applicant a detailed and sympathetic interview. It can act as counselor to those who have just come out of school with high hopes and the energy of youth.

It can help to orient the thinking of these graduates, to suggest what they can do better to qualify themselves for jobs which may open up later. It can keep a careful record of their special abilities and training.

Above all, management can and should be careful to avoid giving the impression that these new recruits in industry are unwanted. They can be treated in such manner as to preserve their confidence, their self-respect and their enthusiasm.

For many of these graduates, their first contact with industry will be their appearance in management's offices as job applicants. It is imperative that they get a good impression, because they will pass along their reaction to their families, friends and neighbors.

In handling this year's graduates, management has a chance to do two things. First, it can build itself a roster of acceptable candidates for jobs when they open up. Second, it can do its part to see that the new generation now coming into industry is favorably received and gets the feeling that private enterprise has a warm and sympathetic understanding of their personal problems.

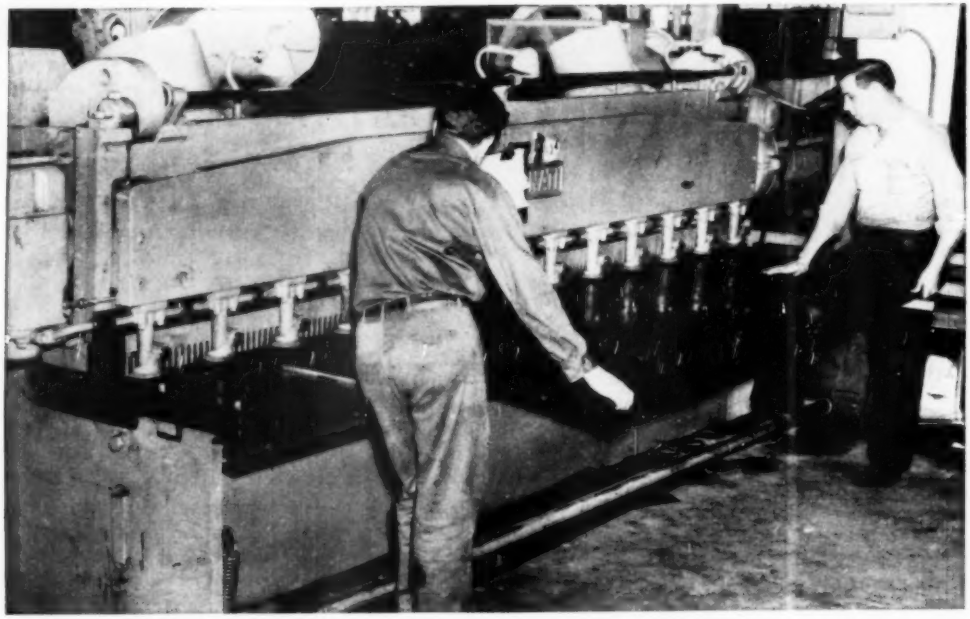
No matter how much is said and printed about the virtues of private enterprise, as contrasted with other economic systems, most of its value will be destroyed for the person just starting in if he is made to feel unwanted.

The 1949 graduates of our schools and colleges are, as one observer put it, "America's most important new resource." Our attitude toward them should be governed accordingly.

Burnham Finney

EDITOR

Building THE HOME OF THE HAMBURGER!



Accurately shearing 96" enameling sheet.

Photos—Courtesy White Castle System, Inc.

The steel building is here, and in increasing demand. Cincinnati all-steel shears helped produce the all-steel building—and made prefabrication practical.

White Castle System, Inc., was energetic in the development of prefabricated steel buildings. They recognized early that prefabrication calls for duplication of units, and duplication rests on accuracy.

Cincinnati All-Steel Shears shear the panels and shapes for White Castle to thousandths of an inch—smoothing subsequent assembly and keeping down costs—for the cheapest blank is the accurate blank.

Write for Catalog S-5 on Cincinnati Shears—the shears of accuracy.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

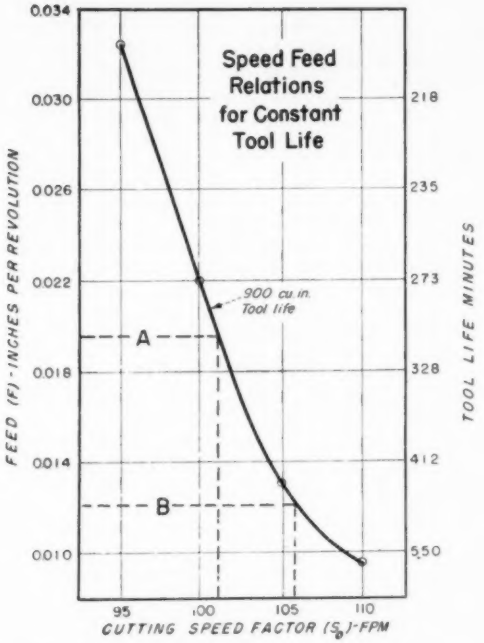


Fig. 1 . . Three major cutting factors are related in graph for cobalt-tungsten-chromium cast alloy single-point lathe tool (see Fig. 3). Curve was charted from formula, Equation 1, developed from machining tests. Graph is based on tool life of 900 cu in of metal removed. Similar graphs can be prepared for other tool-life values

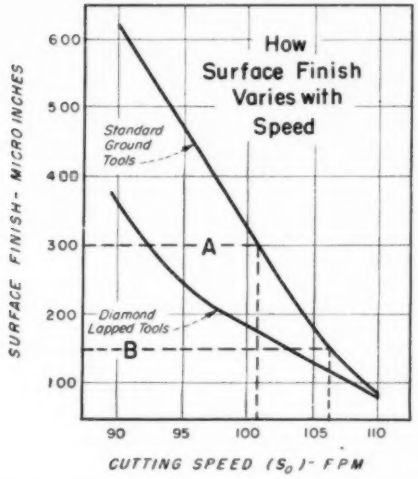


Fig. 2 . . Surface finishes that can be expected for lathe spindle speeds selected from Fig. 1, can be determined from above graph. Improved finish on the surfaces of cutting edges betters tool life and finish on work

HOW DO SPEED AND FEED AFFECT TOOL LIFE?

Speed-feed charts determine most effective cutting conditions for cast-alloy lathe tools . . . Data can be applied in any shop

By THOMAS BADGER, Manufacturing Engineer
Headquarters Manufacturing Engineering Department
WESTINGHOUSE ELECTRIC CORPORATION

A SIMPLE, accurate, speed-feed-tool life formula has been developed by Westinghouse Electric Corporation for use with single-point cast-alloy tools of the cobalt-tungsten-chromium type. From this formula, charts may be constructed so data can be obtained without extended calculations.

Overcoming drawbacks long associated with formulas relating speeds, feeds, and tool life, this new procedure offers several advantages in operation: (1) Most effective cutting speed for a given application can be predetermined. (2) Tool life under most effective cutting conditions can be predicted. (3) The level of efficiency for prevailing shop practice can be determined. (4) Quality of tool materials and of tool grinds can be checked. (5) Skill in establishing the best cutting conditions can be checked without offending anyone. (6) Information can be developed for training production personnel in manufacturing techniques.

In discussing this procedure, no attempt will be made to present the laboratory and mathematical development of the formula but the practical method of developing a speed-feed chart from this formula will be given.

Heart of the procedure is the speed-feed-tool life graph, Fig. 1, and the surface finish graph, Fig. 2. These have been prepared for a cobalt-tungsten-chromium tool of the type and size indicated in Fig. 3.

The graph in Fig. 1 was developed from the formula:

$$L = 2952 - 6690\ F - 24.88 S_o + 0.05865 S_o^2 \qquad (1)$$

Where:

L = Tool life in cubic inches of metal removed.

F = Feed (in. per rev)

S_o = Cutting speed (fpm)

Plotting points for the curve were obtained by selecting a tool life of 900 cu in. and substituting in

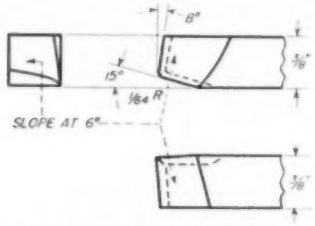


Fig. 3 . . Cast-alloy lathe tool of cobalt-tungsten-chromium and with above design must be used in applying graphs in Figs. 1 and 2. Other tool shapes require variations in the basic formula

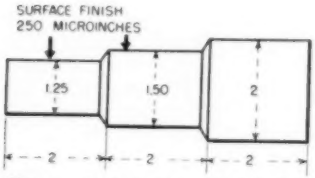


Fig. 4 . . Part is to be rough turned from 2-in. dia bar of SAE 1113 steel. Text gives method for determining proper speed, feed, finish anticipated, and horsepower requirements for each of the two required cuts

Equation 1. Solving for F and S_n produced the speed and feed values indicated on the graph.

For determining the tool life in minutes (see scale on right, Fig. 1), the following equation was used:

$$\text{Time} = \frac{\text{Total Metal Removed,}}{\text{Metal Removal Rate}}$$

or

$$L_m = \frac{M}{(12 \times S_n) \times F \times D} \qquad (2)$$

Where:

L_m = Tool life (min)
M = Total metal removed (cu in.)
S_n = Cutting speed (fpm)
F = Feed (in. per rev)
D = Depth of cut (in.)

The value substituted for M in Equation 2 was the same as the value for L in Equation 1. The procedure then was to substitute the values of S_n and F for each point on the curve where the tool life in minutes was desired, and solve. D was taken as $\frac{1}{8}$ in.

Referring to Equation 1, by substituting values of L other than 900 cu in. a number of curves similar to that of Fig. 1 can be obtained. Equation 1 is valid for a range of values of L from 150 to 1000 cu in.

Formula Gives Other Curves

An examination of Equation 1 indicates that this equation merely shows how cutting speed, feed, and tool life are related. Thus, it would also be possible to set a constant value of either feed or speed and then solve for the remaining pairs of values. This will produce two more curves. One will show the relationship of tool life in cubic inches and cutting speed in feet per minute for constant feed. The other will show the relationship of tool life in cubic inches and feed per revolution for constant speed. These curves have little practical use and will not be considered here, but anyone desiring such curves for specific purposes easily can construct them by substituting the desired constant values in Equation 1.

Any desired speed-feed curve could be substituted for that shown in Fig. 1. To construct another graph it is only necessary to substitute another value of L in Equation 1. The practical range of L which may be used in this equation is from about 300 to about 900 cu in. If higher values of L are used the metal removal rates will be low, the tool life high, and the unit cutting times will be high. If low values of L are used, the metal removal rates will be correspondingly higher, the tool life will be low, and the unit cutting times will be low.

In making a practical selection of a value of L on which to construct a speed-feed graph, it is necessary to balance the desired tool life with the range of speeds available. When this selection has been made, unit cutting times will be fixed for operations set from the graph. In Fig. 5 the effective area of Equation 1 has been indicated by dashed lines. This restriction is made because this is the range of values used in collecting data for the formula and checking results of the formula derivation.

As a practical matter, any attempt to raise the level of cutting efficiency could be effected by using a value of L as low as possible within the restrictions of the speeds, feeds, and horsepower available on the machines to which the chart would apply; and then increasing tool life by improving the tool grinding. Careful testing has proved that improving the surface finish of the cutting edge of the tool from the range of 18 to 30 microinches rms to a range of 5 to 8 microinches rms will result in an approximate doubling of tool life.

How to Use the Charts

Charts shown in Figs. 1 and 2 are used as follows:

(1) Select the highest reasonable feed rate F available on the machine on which the operation will be performed.

(2) Locate this selected feed rate on the left-hand vertical scale of Fig. 1. Then move right in a horizontal direction to the intersection with the curve. Then continue downward and read the basic cutting speed S_n on the bottom scale. By returning to the intersection of the curve and moving to the right-hand scale, the tool life

Table I
MACHINABILITY FACTOR (K_m)

MATERIAL TO BE MACHINED	FACTOR (K_m)
SAE 1113	1.34
SAE 1040—159 Bhn	1.00
SAE 1040—212 Bhn	0.68
SAE 4140—352 Bhn	0.51

Table II
DEPTH OF CUT FACTOR (K_d)

DEPTH OF CUT IN INCHES	FACTOR (K_d)	DEPTH OF CUT IN INCHES	FACTOR (K_d)
1/32	1.33	1/4	0.92
1/16	1.17	3/8	0.91
1/8	1.00	1/2	0.89
3/16	0.94	3/4	0.85

Table III . . . HORSEPOWER FACTOR FOR TURNING AND BORING (V)

MATERIAL MACHINED	FACTOR (V)
SAE 1113	10.22
SAE 1040	11.36
SAE 4140	13.25

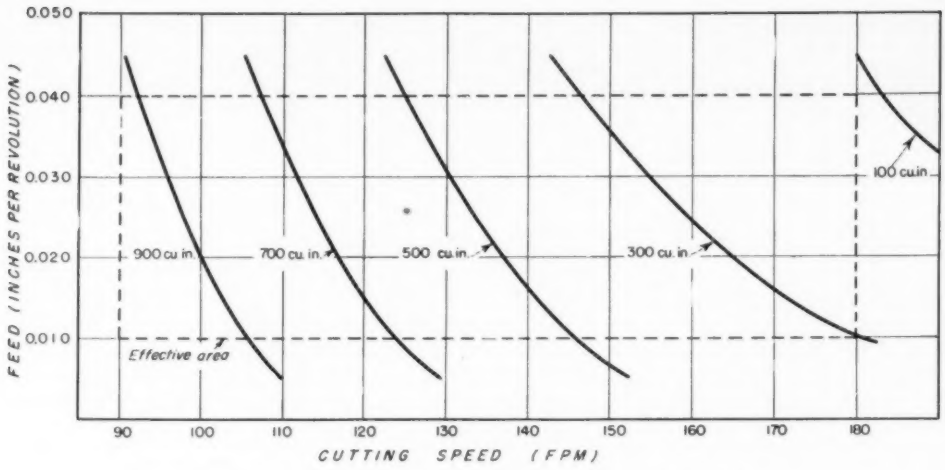


Fig. 5 . . Effective range of Equation 1 is indicated by area with dashed lines. Restriction is made because this is the range of values considered when collecting test data and when checking the formula

in minutes per grind L_m can be determined.

(3) Select a point on the bottom scale of Fig. 2 that corresponds to the basic speed S_o selected from Fig. 1. The upper curve in this graph is applicable when using tools of standard grind (rough ground with a 60-grit aluminum oxide wheel and finish ground with a 100-grit aluminum oxide wheel). The lower curve applies when using a tool that first has been standard-ground, and then finish-lapped on a diamond wheel. After the point on the S_o scale has been selected, move up to the intersection with the proper curve, and then left to the surface finish scale. The reading thus obtained is a prediction of the surface finish that will be produced when using the speed selected with Fig. 1. If this predicted finish is satisfactory, proceed to step 4. Otherwise it will be necessary to repeat steps 1 and 2 to determine cutting conditions that will produce a satisfactory surface finish.

(4) After a satisfactory value for S_o is determined, substitute in the following formula:

$$S_{dm} = S_o \times K_m \times K_d.$$

(5) Refer to Table I and select a machinability factor K_m for the material being cut. Substitute this value in the formula.

(6) Select a depth of cut factor K_d for the material being cut from Table II, and substitute this value in the formula.

(7) Solve the formula for S_{dm} by multiplying $S_o \times K_m \times K_d$. The result is the cutting speed in feet per minute that can be used to make the cut.

(8) If there is any doubt as to the ability of the motor drive to turn the work at the cutting conditions selected, select a horsepower factor for the material being cut from Table III and solve the following formula for horsepower required:

$$HP = S_{dm} \times F \times D \times V$$

Where,

HP = Horsepower required
S_{dm} = Cutting speed (fpm)
F = Feed (in. per rev)
D = Depth of cut (in.)
V = Horsepower factor (Table III)

If power required is in excess of that available on the machine it will be necessary to reduce either the speed, the feed, or the depth of cut, sufficiently to obtain a horsepower value suitable for the machine being used.

(9) Convert the cutting speed (S_{dm}) finally selected into revolutions per minute, and use the speed available on the machine that is closest to this value. Also use the previously selected feed rate and depth of cut when setting up.

The use of these data can best be illustrated by considering a specific problem. Fig. 4 shows a sample piece which is to be turned in a No. 4 turret lathe with a 2-in. dia collet capacity. Longitudinal feeds available are: 0.003, 0.005, 0.0075, 0.012, 0.0195, and 0.030 in. per rev. Spindle speeds available are: 30, 39, 54, 60, 78, 94, 108, 130, 177, 188, 232, 260, 320, 354, 423, 464, 544, 640, 766, 864, 1108, and 1532 rpm. A 5-hp motor drives the machine.

The problem is to select the speed and feed necessary to do the operation in the least time, to produce an acceptable surface finish, to predict tool life, and to keep power consumption within the horsepower available.

Referring to Fig. 4, reducing the 2-in. dia to 1.50 in. would require a ¼ in. depth of cut, but a 250-microinch finish is required. Noting the feeds available, 0.030 in. would not seem reasonable so the next lower value, 0.0195 in., is selected for trial. Fig. 1, *A*, shows a value of 101 for S_o for this feed rate.

To determine if this speed will produce an acceptable surface finish, use Fig. 2. For the value of 101 for S_o the curve for standard ground tools shows that a surface finish of about 300 mu. in. can be expected (*A* on Fig. 2). The finish

requirements could be met by using a diamond-lapped tool, but since we are using a standard ground tool the feed must be reduced for an acceptable finish.

The next lower feed rate available on the turret lathe is 0.012 in. Proceeding as before, the value of S_v for a feed rate of 0.012 in. is found to be 107 (*B* on Fig. 1), and the predicted surface finish is 160 mu. in. (*B* on Fig. 2). Noting the right-hand scale of Fig. 1, a tool life of 471 minutes can be predicted. This seems satisfactory.

From Table I select the value 1.34 for the machinability factor (K_m) for SAE 1113 steel, and from Table II select 0.92 for the depth of cut factor (K_d).

Substituting these values:

$S_{dm} = S_v \times K_m \times K_d$

$S_{dm} = 107 \times 1.34 \times 0.92$

$S_{dm} = 132$ fpm

This value for S_{dm} is the cutting speed that may be used with the selected feed, and tool life will be as predicted from Fig. 1. In this case, a feed of 0.012 in. per rev and a speed of 132 fpm can be used. At these conditions a tool life of 471 minutes and a surface finish of 160 mu. in. can be anticipated.

Satisfactory cutting conditions for this first cut on the work thus have been selected. However, if any doubt exists as to whether the machine will pull the cut under these conditions, the formula given for horsepower can be used.

In this instance:

$S_{dm} = 132$

$F = 0.012$

$D = 0.250$

$V = 10.22$

$HP = 4.05$

For the second cut, S_{dm}, F, and K_m are the same. As the depth of cut is $\frac{1}{8}$ in., it will be necessary to change this value. From Table II, K_d for $\frac{1}{8}$ in. is 1.00. Substituting these values:

$S_{dm} = 107 \times 1.34 \times 1.00$

$S_{dm} = 143$ fpm

In setting up for these cuts, the closest machine speeds available should be selected. As 132 fpm on a 2-in. dia is 252 rpm, the closest machine speed (260 rpm) should be selected for the first cut. Similarly, 354 rpm should be selected for the second cut, since 142 fpm on a 1.5 in. dia is 363 rpm.

Note that only five variables need to be considered in solving any problem with these charts and the formula for S_{dm}. These factors (speed, feed, depth of cut, material being cut, and resulting tool life) are those having the greatest effect on any metal cutting operation. If the many minor factors that can affect a cutting operation are to be considered, the formula soon becomes too involved for shop use. Then, too, some of these minor factors will tend to reduce the permissible cutting speed (or feed), while others will tend to increase them. The sum total of all the minor factors may be considered to be much smaller than the chance variations to be expected between any two cuts with no change in any of the variables.

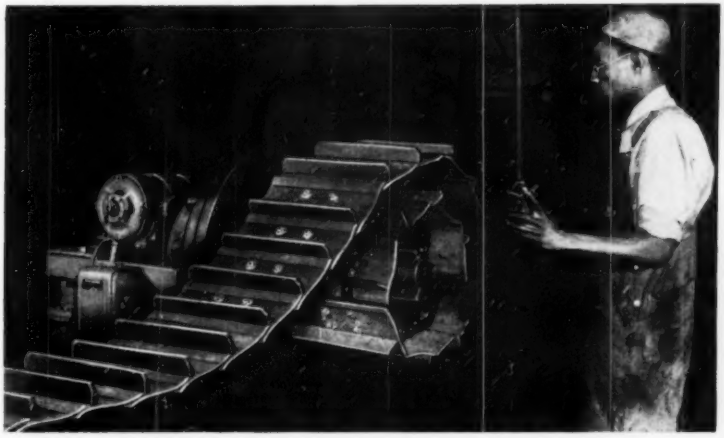
What variation can be expected between individual cuts when set from such data as these charts? Once the speed, feed, and work material are fixed in any operation, the variation will occur in the life of the tool. In any series of cuts, all values will fall within plus or minus 15% of the average. The possibility of obtaining one of the high or low values is about 1 in 20, and this value has a one-to-one-chance of being a high value rather than a low value. Obviously, little danger exists of getting a low value of tool life on any single cut.

All data used in constructing the graphs and tables in this work were based on the average of five cuts for each value. If five or more cuts are made under any given set of conditions selected from the formula, the average of these cuts should be within plus or minus 5% of the chart value. In check tests, made under carefully controlled conditions, values within plus or minus 1.5% were obtained.

Filter-Paper Analysis of Metals

MICRO-ANALYSIS of metals, whereby amounts of the constituents between one millionth and one thousandth of a gram can be detected and analyzed, is now being employed by the Chemical Research Laboratory, Teddington, England. The process is known as filter-paper analysis. Different constituents can be separated because of the differing rates at which, in solution, they spread along a piece of filter-paper. When the paper is dried, the elements can be seen as separate bands and can be identified by conventional chemical methods.

. . . "And why not? She practically runs herself"



Coiling machines pick up crawler tracks from the assembly conveyor and form them into rolls for ease in handling through the cleaning and painting machines. This solved a major problem in handling these awkward and heavy assemblies

MECHANIZED HANDLING CUTS FLOW-COATING COSTS

Finishing costs of tractor track assemblies are substantially reduced

Parts are handled mechanically through cleaning and painting cycle

BY H. M. ALKIRE, assistant to works manager
Springfield Works, ALLIS-CHALMERS MFG. CO.

FLOW-COAT painting of track assemblies for crawler-type tractors at the Allis-Chalmers Springfield Works has made possible a considerable saving over the previous cost of hand spray painting. In addition, the sytem installed for track assemblies has been found suitable for painting other tractor parts, and additional savings are being realized.

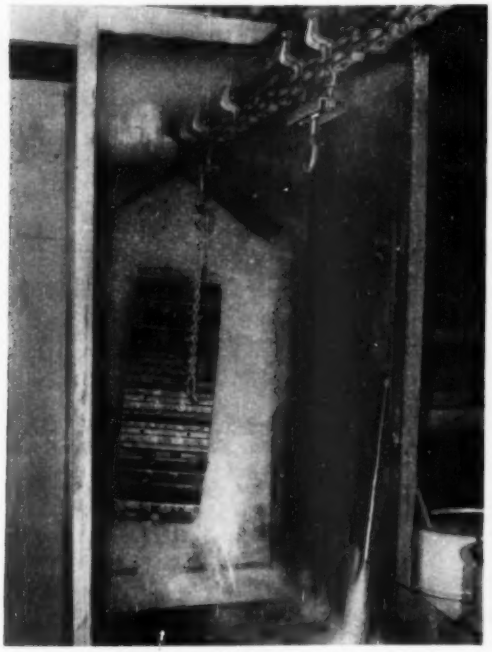
The flow-coating system is about 200 ft long, and consists of an overhead motor-driven chain conveyor on which the coiled track assemblies are hung with a crane. The continuously moving conveyor carries the tracks through a two-stage wash-and-rinse machine, an open area for cooling, the automatic flow-coating booth, an open area for dripping, and a 60-ft-long baking oven. Work is removed from the conveyor at the discharge end of the oven, either with an overhead crane or with a power lift truck equipped with a central horn.

Original plans for the system were worked out by Allis-Chalmers engineers in cooperation with a conveyor manufacturer and the paint supplier. They studied the time required for washing, cooling, painting and baking flow-coated finishes on the track assemblies to determine the over-all length of the system, the length of each individual unit, and the desirable speed range for the conveyor. Paint engineers developed a special paint and thinner for the system. The paint is slower drying than that previously used for spray painting the same parts, and a detergent was added to prevent separation due to the churning action of the paint pump. The thinner is slower acting than are thinners used for spray painting, to reduce evaporation.

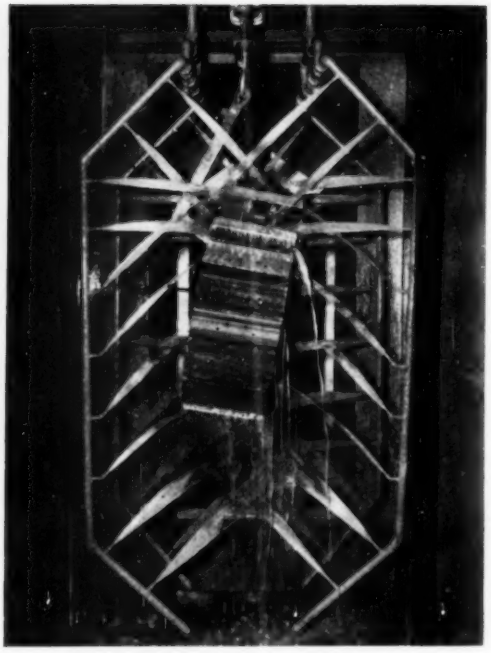
Parts are carried on a chain conveyor suspended from an I-beam track 10 ft above the floor and moved by an adjustable speed drive powered by a 2-hp Allis-Chalmers motor. Chain travel usually is from 2½ to 3 fpm.

Work is cleaned before painting in a two-stage washer 36 ft long, and 78 in. wide. Tanks for the washing and rinsing solutions are in 3-ft-deep pits under the washing machine. Solutions are heated to 165 F with submerged steam injectors.

Spray assembly in the washing stage has 174 nozzles to which the washing solution is fed from a 1780-gal. storage tank by an Allis-



Two-stage washing and rinsing unit has 174 spray nozzles for washing and 140 rinse nozzles to remove all dirt and grease before painting. Washing solution contains caustic soda and phosphate and is used at 165 F. Hot rinse contains potash

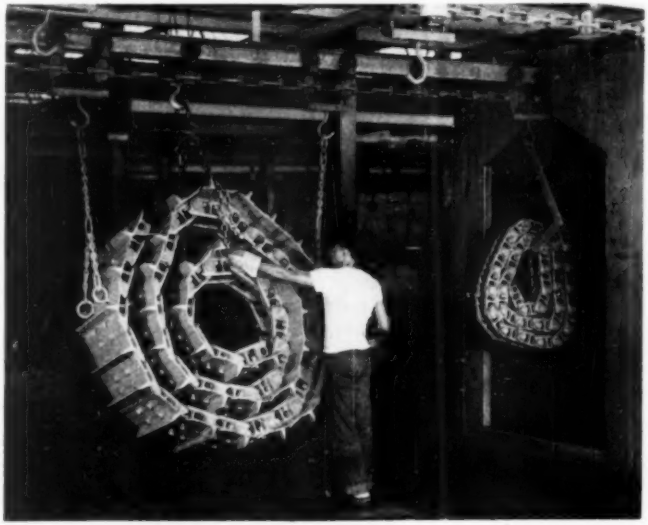


Criss-cross pattern from 40 paint spray nozzles insures adequate coverage of all inside and outside surfaces. Nozzles are finer than is usual in flow-coating operations. Installation saves 50 gal. of paint every 8 hr compared with hand spray painting

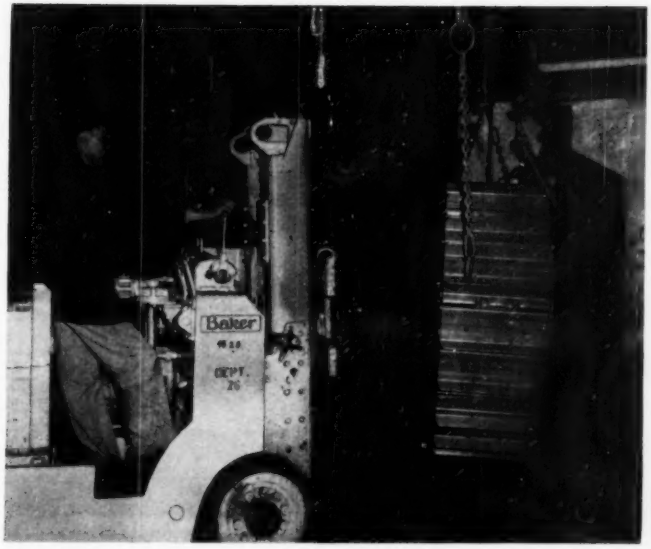
Chalmers 700 - gpm, 60 - ft - head Electrifugal pump close-coupled to a 15-hp, 1750-rpm totally enclosed, fan-cooled motor. The solution consists of 30 lb of caustic soda and 30 lb of phosphate in 1780 gal. of water. Daily makeup when operating for one 8-hr shift is 10 lb of caustic soda and 5 lb of phosphate, with enough water to keep the tank full.

The rinse section has 140 spray nozzles to which the rinsing solution is pumped with a 450-gpm, 50-ft-head Electrifugal pump close-coupled to a 7½-hp, 1750-rpm totally enclosed, fan-cooled motor. Capacity of the tank is 1130 gal. The rinse solution consists of 15 lb of potash in enough water to fill the tank.

A 55-ft-long open section separates the washing machine and the flow-coating booth. This provides time for the work to cool sufficiently before paint is applied. Cooling time is 18 to 22 min, de-



Method of suspension varies with the size of the work. Large tracks are handled on chain slings, smaller tracks are hung on special hooks. Suspension angle is critical to insure proper paint coverage of all surfaces. Angle of 10 to 15° is best for most work



Power lift truck with central horn takes coiled track sections from paint conveyor. This avoids excessive handling on outer surfaces and prevents marring the paint which is tacky until the work has cooled to well below baking temperature

pending upon the speed of the conveyor.

In the flow-coating booth, two vertical pipe sections in each side of the booth each carry 10 specially designed paint nozzles on 1-ft centers. The 40 nozzles are directed to adequately cover the area between the supply pipes with a criss-cross curtain of paint so all surfaces of each workpiece will be coated with a direct flow of paint from one or more nozzles. The nozzles provide finer streams of paint than is normal in most other flow-coating installations because of the need to flow the paint into the fine sections of the coiled track assemblies.

The exhaust fan above the spray booth is adjusted so fumes do not escape into the room, but so there is a minimum of air drawn from the booth. Otherwise, too much paint and thinner would be drawn into the exhaust lines. A paint eliminator in the exhaust duct ahead of the fan minimizes paint buildup on the fan blades. Special fusible connections are installed in the exhaust fan and paint pump motor circuits so paint flow and air movement are stopped quickly in case of fire.

The system holds about 200 gal. of paint and thinner, including that stored in the 158-gal. tank in a 4-ft-deep pit under the flow-coating machine and in the supply pipes and drain pans during normal operation. Flow of paint to the 40 spray nozzles from the 150-gpm capacity centrifugal pump in the paint tank pit varies from 100 to 125 gpm, depending upon the viscosity of the mixture being used.

For flow coating heavier parts and assemblies, like the coiled track sections, the mixture consists of 17 gal. of thinner for each drum (53 gal.) of special persian orange enamel paint. A thinner mixture is used for sheet-metal parts.

When painting the track assemblies and other heavier parts, additions during each shift average 40 gal. of paint and 53 gal. of thinner. The thinner is added slowly, only about 3 gal. being put into the tank at a time. Because lighter parts lose their heat more rapidly while being moved from the washing machine to the spray booth, there is less evaporation of thinner during the painting operation on these parts.

Control of the paint mixture is in the hands of the spray booth operator. He checks the viscosity at least four times every 8-hr shift —oftener if visual inspection of the spray pattern indicates that the paint is not flowing properly. Standard viscosity testing equipment is used. For the heavier parts, the mixture is held at an average viscosity of 30 sec Saybolt.

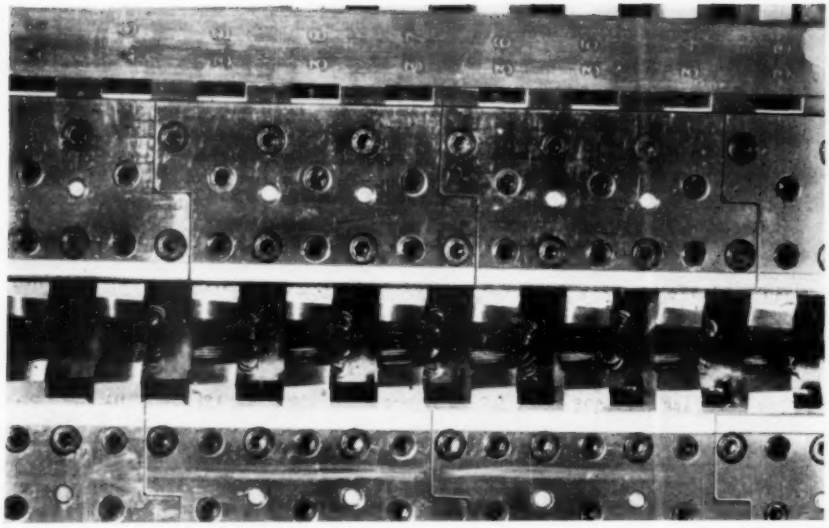
At the end of each 8-hr shift, 12 gal. of thinner are pumped through the paint pipelines to clean the nozzles and screens. If the system is to be shut down for more than 24 hr, all paint is pumped out of the tank into drums, and sediment is cleaned from the tank and from the drain pans in the booth. In addition, the pipelines and nozzles are cleaned by pumping thinner through them. At the end of each week, nozzles and pipes are removed and placed in a tank of caustic soda solution. They are left in this tank for a week, while an alternate set is being used.

Experience has shown that it is not desirable to finish heavy and light parts at the same time. Where both types are to be finished, they are put on the conveyor in as large lots as possible, so proper paint mixtures can be prepared and used for extended periods of time. It takes a little while to adjust the viscosity of the paint to suit different types of work put through.

Painted work is baked in a steam-heated oven at 235 to 240 F. The oven is heated by blowing air past steam coils and into distribution ducts mounted along each side. The hot air circulates about the moving work and is exhausted through a roof stack by a blower. When parts come out of the oven, they are slightly tacky, but tackiness disappears a they cool.

Light But Right

Railroads are shifting their shops to handle diesel locomotives—and needing accurate but inexpensive machine tools—built with maintenance work in mind. A full-scale, versatile, toolroom machine is a bit rich for present budgets.



CROSSBREED MACHINE TOOLS MAY SOLVE JET JOBS

Machining the pine-tree form on aircraft gas-turbine blades and wheels, precision drilling and turning concentric rings, present new problems

BY E. J. TANGERMAN, Managing Editor

THE PINE-TREE FORM on gas-turbine blades and wheels represents a major machining problem, both because of the materials and because of the tolerances which must be maintained. The initial solution of the blade problem was by grinding. Both grinding (with an adapted thread grinder) and broaching are in current use on blades, and broaching on the wheels.

The heat-resisting materials for these parts are, however, relatively soft, so they tend to crush and tear when broached in the conventional way. Teeth should be provided with some rake, difficult to grind in because of limited clearances in a solid form broach. Normal tooth spacing is about $\frac{3}{8}$ in., which demands an extremely small grinding wheel for backing off and also provides very limited chip clearance. The soft chips tend to cling and pack, are hard to handle. Further, because of the large number of blades per turbine (something like 2000), an extremely fast method of production must be devised if demands in the event of national emergency are to be met. Thus far, the only solution offered has been the suggestion that the materials be made harder, so they can be broached. But the harder materials can't do the job.

One solution, now under development by Arthur A. Merry, chief tool engineer of Pratt & Whitney Aircraft, involves an inserted-tooth broach, a section of which is pictured here. Teeth are of Vascoloy Supreme, which has a hardness of 67-69 Rockwell C. This type of broach has been tested at various times by several companies, including Ford, but not for parts of this accuracy.

Teeth may be ground and backed off to any desired shape or rake, and require a spacing of $\frac{3}{4}$ in. or more, allowing plenty of chip clearance. Cutting-edge hardness can be quite uniform, something extremely difficult to attain with a long solid broach.

Such a broach, however, may be as much as 180 in. long, twice the stroke of a conventional broaching machine. To attain the necessary stroke, Mr. Merry mounts his broach on a planer bed and the work—either blade or wheel—on the crossrail. With this setup, he can maintain desired accuracy on both aluminum and Nimonic 85 (a high-nickel blade stock) and has taken as much as 0.003 in. chip load

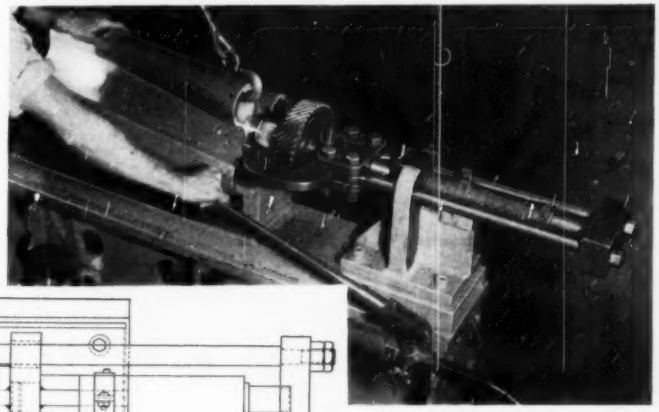
per tooth. He feels a chip load of 0.007 in., equal to that in form milling, is readily possible and that a horizontal broaching machine—basically a planer without planer tool and feed adjustments—is the next step. Such a machine would have to be massive, but fast. He feels also that roughing in a gear shaper should be practical, if suitable equipment can be made available.

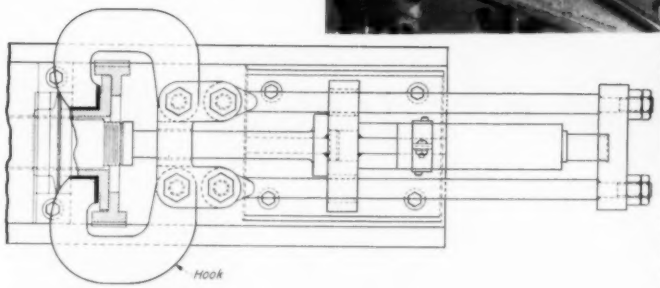
To make broach teeth, Mr. Merry is using a new type of dresser, the Diaform, developed in England, which Pratt & Whitney Tool is now offering in the U. S. It dresses the wheel with a diamond point, guided by 10-1 templet, and Mr. Merry has found it possible to dress the wheel and grind a broach tooth to tolerances under 0.0005 in. in about a half hour. With the aid of this unit, he expects to be able to grind carbide broach teeth also. With a cutting bit for roughing, and a diamond for finishing, the dresser would turn contour disks of copper which afterward could be impregnated with diamond dust to make laps. Carbide teeth would make the broach capable of handling any material, even if highly abrasive.

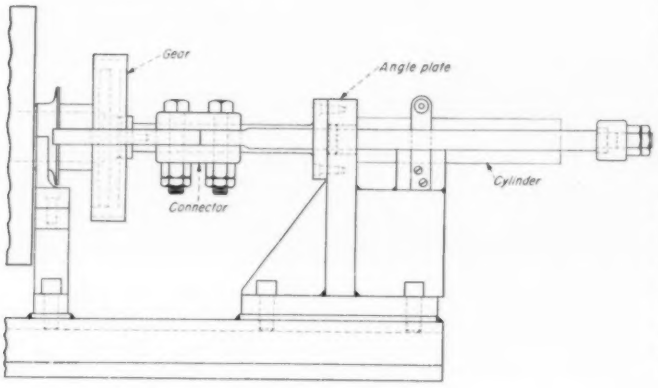
Mr. Merry is also building another machine for the turbine project, to handle drilling of the large concentric rings for the turbine case. It will be basically a drilling machine, but probably with a precision-jaw boring-mill chuck capable of handling rings up to 42 in. in diameter. With it, he will use carbide drills. Such a setup will be capable of fast drilling of holes in an accurate circle.

Next after that on the deveopment program will be a big lathe, again with 42-in., or greater, swing but designed to take only light cuts. It will be faster and far less massive than available lathes of that swing. Primary work will be turning the rings for the turbine case, so the machine will be carbide-tooled also.

Hydraulic Gear Puller Speeds Compressor Construction



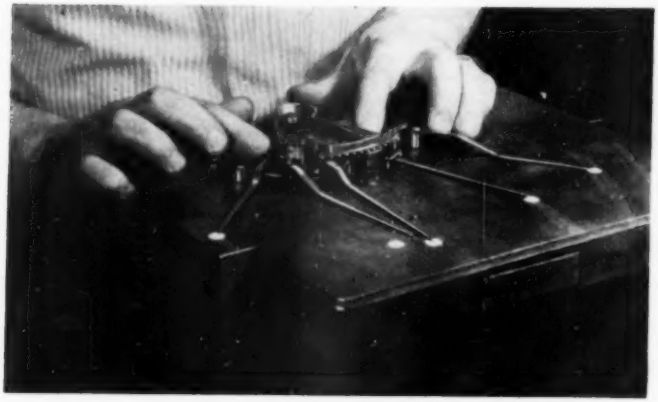




After rotor shafts for air-compressor blowers have been dynamically balanced, the drive gears must be pulled off so finishing operations can be completed. An efficient puller mounted at convenient height on a welded steel base does the job at Allison Div., General Motors Corp.

A heavy angle plate mounts the hydraulic ram horizontally and also holds hardened bushings that guide the two 1-in. drawbars. The threaded ram piston fits into a steel crosshead that also anchors the bars. Gears are gripped by two hooks that are bolted, like the drawbars, to a heavy double yoke. A cap with an OD slightly smaller than the OD of the rotor shafts is mounted on an anvil that extends from the angle plate. Power is provided by a hand pump.

TEST JIGS INSURE ACCURATE PARTS



WHITE BUTTONS inset in cast-iron baseplate have scribed gage lines 0.003 to 0.010 in. wide filled with black paint to eliminate eye strain. Fixture shown checks pin holes and shaved test points on gear sector for desk model adding machine

Inexpensive gaging fixtures with guided plug gages and indicating pointers simplify inspection of small parts to close limits

BY CLARENCE DUNLOP
Works Manager
BURROUGHS ADDING MACHINE CO.

PROGRESSIVE assembly techniques now used in the manufacture of Burroughs calculating and accounting machines makes necessary the production of parts to very accurate dimensional tolerances. This introduces inspection control problems because more than a million parts a day are manufactured in the Detroit plant. And as many as 15,000 parts are assembled in some models.

Many of the parts are sheet-metal stampings blanked to shape, then formed and shaved or ground to the required dimensions. Burroughs engineers have developed inspection fixtures which permit rapid, accurate checking of the critical dimensions on these and similar parts. Known as "test jigs," these fixtures are used extensively for dimensional control. They employ locating plugs or blocks to position the work accurately with relation to pointer arms or guided plug gages. Tolerances ranging from ±0.0005 to ±0.002 in. are easily checked.

For checking external dimensions, 15-to-1 and 20-to-1 indicator arms are used. The indicating ratio of the arm selected to check a given point is determined by the accuracy required. Where hole location and size must be checked, the fixture baseplate is provided with legs to support it above the bench, and plug gages are guided in hardened steel bushings in the baseplate. The inspector inserts her hand under the baseplate to move the plug gage up into the hole in the work. Each such gage has a shoulder to prevent it from falling out of the bushing.

Master samples are machined in the toolroom to within 0.0002 in.

TEST JIGS are checked against master samples in central Standard OK Room. Master samples are reinforced to prevent distortion and copper plated for identification purposes. Three master samples are filed in wood-lined drawers for each operation using test jig. Only test jigs checked with such samples can be used on the production floor

SLIDING PLUG GAGES in hardened bushings can be operated from bottom of baseplate by mounting fixture on legs. Plugs are equipped with collars to prevent them from falling out of the bushings

PERIODIC INSPECTION at the machine by means of the test jig enables the operator to check that tools are remaining in proper adjustment. Note handle for convenience in carrying jig to toolcrib for first-piece inspection

on all locating and test points when the fixture is assembled. These parts are reinforced to prevent bending or warping in use, and are copper plated to prevent rusting and to provide identification as master samples. When the fixture is released for production, the master samples are filed in the "Standard OK Room" where all test jigs are checked against these masters each time they are to be used.

When a new job is assigned to a machine operator, he obtains his tools and the necessary gaging equipment, including the test jig, from the tool crib. He then takes the test jig and other gages to the Standard OK Room for checking against the master samples. If any defects are found, a repair order is written and the gage is sent to the toolroom for repair. At the same time, the operator is instructed to report to his foreman and advise him that the job cannot be run until the gaging equipment is repaired.

At the Standard OK Room the following procedure is used for checking and setting test jigs:

1. Check operation card for symbol and code number of workpiece and proper tools.

2. Check for operation to be performed.

3. Consult record file to determine correct master sample to be used in checking test jig.

4. Read instruction plate on test jig for proper setup for the operation to be checked. Change jig to suit, if necessary.

5. Clean test jig carefully with special lintproof rags. This is necessary because the smallest chip or piece of lint will give a false test reading when indicator arms on the jig are checked against the master sample.

6. Examine indicator arms for worn contact points and hubs, also for proper height.

7. Examine locating pins for correct diameter and depth of grooves, allowing not more than 0.0002-in. wear at any location.

8. Check locating blocks and rest pads for wear and proper height.

9. Carefully place master sample in proper position on test jig. Release all holding clamps before moving indicator arms into test positions.

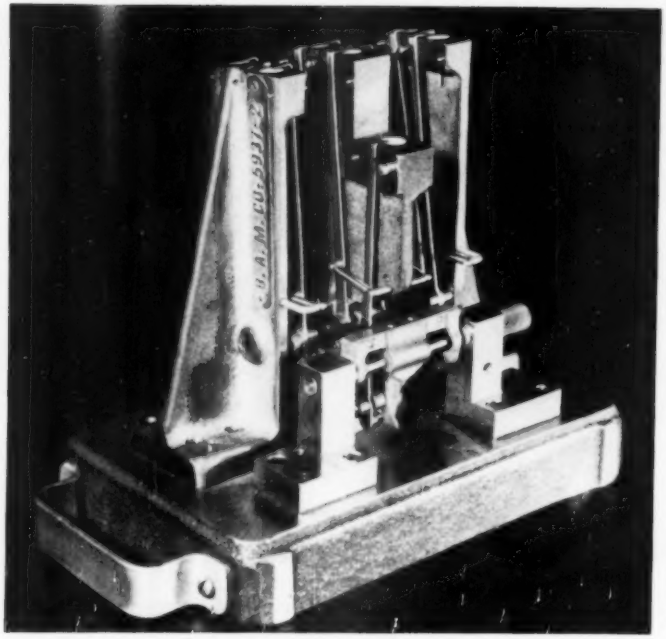
10. Set all indicator arms to exact center of working tolerance lines, making minor adjustments to compensate for slight wear. If major adjustments are necessary, test jig must be returned to toolroom for correction before it can be used.

11. Release holding clamps and carefully remove master sample. Replace master sample in storage cabinet.

12. Stamp operator's work ticket with time and date when test jig has been approved for operation.

Schedule of Checking

Test jigs using 20-to-1 indicator arms for very precise measurements must be rechecked by the Standard OK Room twice each shift, while jigs for checking di-



VERTICAL TEST JIG for checking small subassembly. Work is carried on horizontal pin, and indicator arms are brought into contact with gaging points by operator's fingers. Springs retract arms for loading and unloading fixture

mensions with broader tolerances need be rechecked only at the start of each shift.

After a test jig has been cleared for a new operation, a setup man installs the tools on the machine and makes a test piece. If the setup man is satisfied with this piece, the operator then makes a "first" production piece and takes it, with his test jig, to the toolcrib in his department where the departmental inspector checks it. If it is approved, the operator continues his job, checking parts as frequently as the operation requires on a percentage inspection basis. When he finds dimensions are drifting out of allowed tolerances, he shuts down the operation and calls the setup man to correct the machine or tools. When this is done, the first piece produced by the operator, after the setup man has cleared the machine, must be checked again by the departmental inspector.

Finished parts go to inspection benches for checking with the same or similar test jigs. These test jigs must also be cleared by the Standard OK Room before being used by an inspector, as they were cleared for use by a machine operator.

We Need Some Oilcan Engineering

Harry was standing back of Bill wearing a lop-sided grin on his face while Bill struggled with the shaper-elevating mechanism.

"Why the hell don't they have power on this contraption?" sighed Bill as he stepped back and wiped his dew-dropped brow with an oily rag.

"That's not the answer, friend." Harry pointed to the bone-dry screw that was causing the trouble. "What they need around here is a man whose chief duty is to see that equipment is correctly taken care of—especially oiled."

"Why can't the men do that themselves?" Bill was overheated. It's a mighty simple thing to grab an oilcan once in a while."

"I notice that you didn't put any oil on that screw before you started sweating your head off."

"No, I guess you're right. I just piled in and started cranking."

"That's the trouble. Guys just pile in, forgetting good practice, and cause a lot of unnecessary wear; besides burning up a lot more energy than they need to. I'll bet you a Roosevelt dime that I can show you another piece of machinery that's as dry as your shaper."

"You're on, Harry. Lead the way."

Harry led Bill to his own vise, unscrewed the clamp, and stepped back. "What did I tell you?"

"Okay, here's your dime—and bad for you, too."

"Why bad for me, Bill? It's human nature to neglect such things. I could show you another dozen driel-out tools in the shop."

"Oh, no—that's all the dimes you make off of me today."

"I'll bet that oil is needed in every chuck in the place, and tailstock screws, cross-slide screws, and vise escrews. And I'd bet that you could find a lot of screws with upset ends, too!"

"You're probably right, Harry. I wonder why the foreman hasn't done anything about it?"

"That's one of those things that should be delegated to an equipment supervisor, but seldom is."

Jack Everett
San Francisco, Cal.

POSTERS PROVE THE CUSTOMER IS BOSS AGAIN

HARD-HITTING posters are spearheading a campaign to tighten production, cost, and quality standards in companies of American Type Founders, Inc. Employing a "human relations approach that acquaints employees with the facts of the situation and appeals to their own personal interest and sense of loyalty," these posters remind employees of the need for greater efficiency and better workmanship. Although artwork is varied for individual companies to stress their products, the theme is always the same—"the customer is boss again."

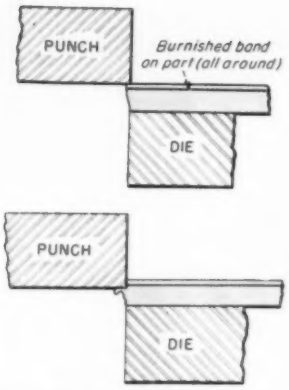
Effectiveness of the cartoons has been boosted by briefing plant supervisors before posting, and by tying in the posters with specific quality, suggestion, and employee training programs. ATF believes that the line supervisor is the key man in the communication chain and that ideas will be transmitted through him in proportion to his acceptance of them. The company also knows that attitudes built up during the past ten years will not be changed by a 1-day, 1-shot effort. Thus, the posters are only a part of a campaign of meetings, conferences, bulletins, special drives, and other measures that may run six months or longer.

Mr. Customer hunts for value . . .

is dismayed by poor workmanship

He beams at employee suggestion . . .

and praises increased efficiency



Figs. 1 and 2—Formation of the chip in shaving of blanks requires more pressure than is often realized

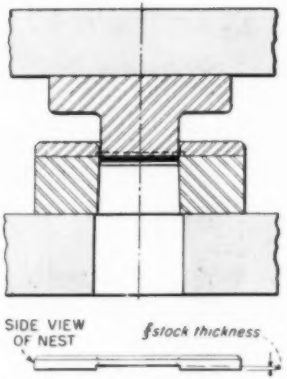


Fig. 3—Most externally shaved blanks can be handled in a die with a nest that fits the piece closely at three or more points

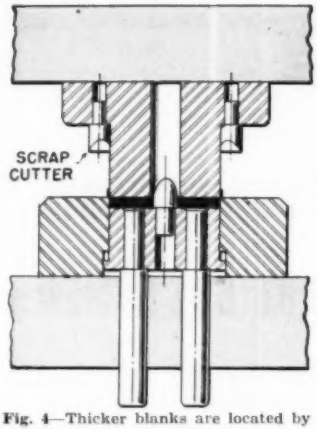


Fig. 4—Thicker blanks are located by pilots; scrap cutters sever scrap rings that pile up on the punch

WHAT TO WATCH IN SHAVING-DIE DESIGN

In most cases, it is possible to use mechanical means to strip shaved parts, which is desirable considering the fact that the stripping pressures are high

BY J. R. PAQUIN, Tool Engineering Consultant

BLANKED PARTS have an edge that is smoothly burnished to a depth of about one-third of the stock thickness. The other two-thirds of the edge are rough and granular in appearance and taper back slightly. This condition is not always satisfactory in product applications. In precision instruments and machines, for example, the edge of the part must be smooth all the way and held to a high degree of accuracy. Where these requirements exist, the part must be shaved after blanking.

The operation of die-shaving closely parallels metal-cutting operations, where a definite chip is taken from the piece. The same requirements of fixture rigidity apply.

Fig. 1 illustrates, in enlarged section, the edge of a part to be shaved. Fig. 2 shows the punch at a lower position of the press ram, and formation of the shaving chip.

Because shaving dies take such a light chip, a frequent mistake is to design the die with sections which are too frail. Pressures exerted in shaving are quite high. Die members should be fully as sturdy as those of the blanking die that produced the part. In fact, stripping of the shaved part requires twice the pressure required to strip a part from a blanking die. (See "Selection of Stripper Springs", *A.M.—p 153, Dec. 18, 1947*).

For a shaving operation to be successful, it is extremely important that the part be shaved from the right direction. The following rules must be remembered at all times:

1. When the outside edge of a blank is to be shaved, the side of the blank having the burnished band must be toward the die opening.

2. When the edge of a hole is to be shaved, the side of the blank having the burnished band must be toward the punch.

These practices insure that chip formation starts from the side of the blank with the burnished edge, and that the sectional thickness of the chip will diminish as the cutting edge advances. If the part were turned around, the cutting edge would start at zero chip thickness, and the chip would become progressively thicker, until it would break away from the part, leaving a rough, broken edge.

The first step in planning a shaving operation is to compute the amount of stock to be removed by the shaving die. If only one shave is to be taken on soft, or half-hard, steel, this amount will be 8% of the stock thickness. When

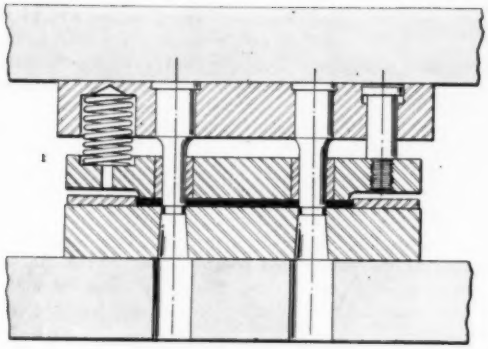


Fig. 5—Scrap rings produced by shaving the holes in the part are pushed down through the die openings

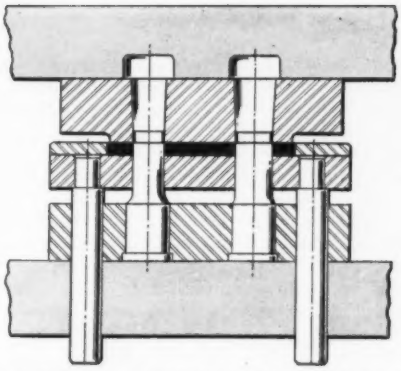


Fig. 6—Stripping is handled in an inverted die by the pressure attachment of the press, in order to avoid a large number of stripper springs

two shaves are required, about 10% of the stock thickness is removed. Two-thirds of this amount are removed in the first shave.

When parts of hard steel, german silver or brass are shaved, the amount removed for one shave is 15% of the stock thickness; for two shaves, it is 19% of the stock thickness. The proportions removed in the first and second shaves remain the same as above.

It is often difficult to decide how many shaves will be required. This decision must be made before the blanking die is dimensioned, in order to add the shaving allowances to it. In general, the number of shaves required will depend on the thickness of the stock, and upon the contour of the part to be shaved. If the contour is not too intricate, and the thickness is under 3/32 in., one shave should be sufficient. On the other hand, if the contour is very irregular, as in gears, cams and racks, and if the stock thickness is over 3/32 in., two shaves should be applied.

Satisfactory Shaving Dies

Various designs of shaving dies are entirely satisfactory, within limitations. Selection of a particular design is influenced by job requirements; that is, part size, accuracy requirements, and production needed. Where one type of die will deliver a high rate of production, it may not meet the accuracy requirements of the job. On the other hand, a die with a high degree of accuracy and ability to deliver flat parts may not be capable to supplying the required rate of production.

Fig. 3 illustrates a die used to shave small, comparatively thin blanks. The blanks are deposited in a nest that fits the part closely at three or more points. When the

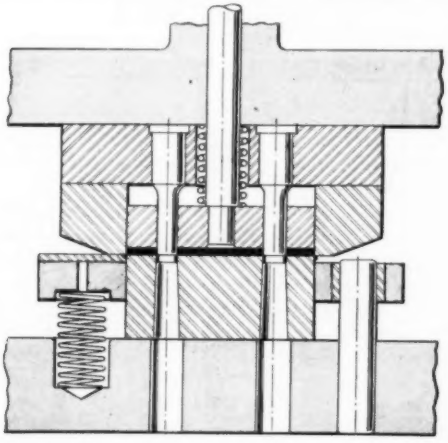
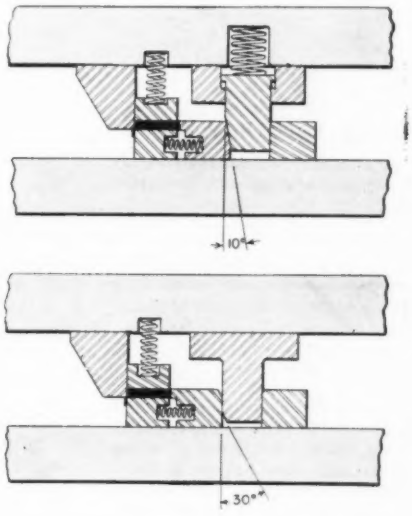


Fig. 7—Positive knockout assists the springbacked knockout in stripping the part from the upper die



Figs. 8 and 9—Cams solidly back up the part when only a portion of the blank periphery is to be shaved →

punch descends, it pushes the blank through, while the edges of the die take a shaving cut from the outer edges of the part. The chip stays in a machined slot in the nest, and is blown off with compressed air. Here the rule for shaving direction is followed. This type of die will be found suitable for the great majority of shaving operations on small parts, where accuracy requirements are not too great.

Where the piece-part must be flat and accurate, a die with a pressure pad should be used. The die in Fig. 4 is used for thicker blanks, and for parts requiring a high degree of accuracy. Two pilots pressed into the pressure pad locate the part. Scrap cutters, pressed into the flange of the punch, cut in half any scrap rings which pile up on the punch. Two rods are fastened to the lower side of the pressure pad, and connect with the auxiliary pressure attachment of the press.

Fig. 5 illustrates a die used in shaving holes. The part is located in a nest fastened to the die block. The shaving punches are accurately guided in hardened bushings pressed in the stripper plate. Scrap holes in the die block and die set are machined in the same way as in the blanking die that produced the part.

An inverted die, Fig. 6, may be used for shaving holes in thick parts. Here, it might not be practical to employ the large number of springs required for stripping the part from the punches. An inverted die allows the use of the pressure attachment of the press for stripping. The scrap rings are pushed up into slots machined in the punch holder of the die set.

Shaved Inside and Outside

It is entirely practical to shave holes, and an outside edge of a blank, in the same die. This application is shown in Fig. 7. The part is located in a nest mounted on the lower pressure pad. When the ram descends, the upper knockout pad, backed up by a heavy spring, contacts the part first and holds it flat while the cutting edges do the shaving. Because of the high stripping pressure involved, it is probable that this spring will not apply sufficient pressure to strip the part from the upper die. However, at top stroke, the vertical rod contacts the knockout bar of the press and transmits pressure to the knockout plate. Thus, the part is effectively stripped.

As the locating nest is mounted on the lower pressure pad of the die, it must be accurately guided. This is accomplished by two hardened posts pressed in the die holder of the die set. Hardened bushings pressed into the pressure pad ride over these posts and keep the pressure pad in correct alignment. One of these is shown at the right of Fig. 7.

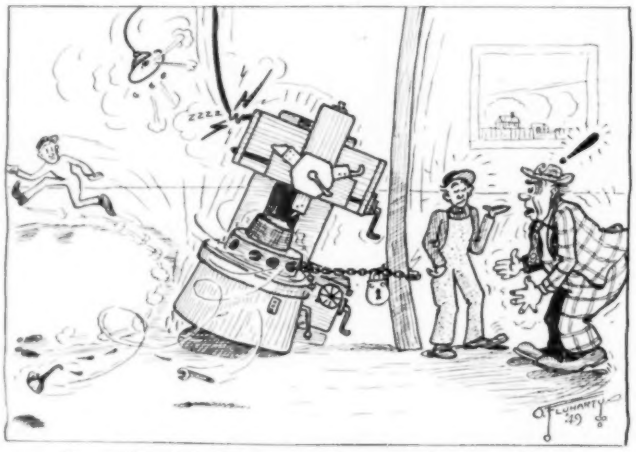
In many cases only a portion of the part must be shaved. In such cases, the part must be solidly backed-up. Otherwise, the part will have a tendency to back away from the punch. Figs. 8 and 9 illustrate cams used effectively to back up the piece. The cam shown in Fig. 8 is used when the width of the part is subject to variation. It will prevent shifting of the part at any point within its limits. When parts are uniform in width, the cam shown in Fig. 9 may be employed for the same purpose.

Shaving has been accomplished successfully in progressive dies, but it is not a recommended practice. For one thing, the clearance between the holes in the strip and the diameters of the locating pilots render accurate part location improbable. Also, as a rule, progressive dies run at too great a speed for successful shaving operations. Presses used for shaving should run at 30 to 45 strokes per minute, while progressive dies are faster.

Tips FOR TOP SHOP MEN

294 When you don't know, say so—and find out. Some people can get away with not knowing, but most of us can't. It's safer to confess—and find out. You may fool others for a time by fast talking, but you usually end up by fooling yourself.

295 Remember that old saying, "Trifles make perfection, but perfection is no trifle." Michelangelo said that 400 years ago, but it's still true. Unless you watch the little things, the big things will go wrong. Details take time, but you've got to be able to do them if necessary, and normally to see that they're done.



You said "Lock the fixture securely before starting the machine"

High polish combines with graceful lines to convert a utilitarian aluminum escalator casing into an eye-filling spectacle

How to Do

Buffing and Polishing

BY JEROME L. BLEIWEIS, Metal Finishing Consultant

ALL that glitters is not gold, but highly reflective surfaces have always appealed to human senses and continue to play an important part in creating that curious intangible known as sales appeal. Automobile hardware is perhaps the outstanding modern example, and although trim strips usually perform a definite function, the average buyer would resist strongly an effort to have them painted in body colors.

A high finish is no guarantee of quality but, on the contrary, may be used to cover an inferior product. Nevertheless, polishing and buffing serve other purposes than merely to appeal to the eye. They are an essential preliminary to most electroplating operations in which a bright finish is required; they materially increase the corrosion resistance of most metals, frequently improve wear resistance, and greatly increase the reflection of light and heat. Unlike most machining operations, they are relatively non-precise, and the question of dimensional requirements is secondary to the physical and specular requirements.

Different materials require different methods and different types of abrasive compounds, and changes in wheel speed and pressure can produce noticeable changes in the quality of the surface. Manual operations are still the most widely used and, when combined with suitable holding fixtures, can frequently compare favorably with automatic machines on a cost basis. Machine polishing, however, insures greater uniformity and is usually cheaper when large quantities are involved.

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POLISHING and buffing may serve any number of specific purposes, but there are seven major reasons for using this type of finish:

1. Production of highly specular reflecting or diffuse reflecting surfaces is associated with the factor commonly known as sales appeal. Most metallic products, aside from their functional utility, require some kind of surface effect to make them attractive to the eye—the first monitor in the selection of manufactured products.

Precedents, long established, demand that articles such as razor blades, heating irons, toasters, and automobile bumpers be highly buffed or satin finished, primarily because of the sales appeal thereby imparted. Articles in the novelty and costume jewelry field have, frequently, very little intrinsic value and sell only on the basis of their finishes.

2. Corrosion is a surface phenomenon, accelerated by surface heterogeneity and retarded by surface homogeneity. Smooth, polished surfaces will evince a lesser tendency to corrode than the more physically heterogeneous unpolished surfaces. Polishing and buffing are frequently resorted to for this purpose where requirements are such that plating or other coatings are inadmissible. Examples may be found in steel sheet or rod and in moving machine or instrument parts.

3. Smoothness or planeness of surface is frequently important where wearing surfaces are involved. This is achieved by polishing and buffing and is exemplified by the smooth finish on moving textile parts and in some cases in Superfinishing operations. Utilitarian mechanical smoothness on articles such as electric-razor heads, shovels and needles is also attained by polishing and buffing.

4. Visual inspection for surface defects is frequently expedited by polishing or buffing. A specific application of this is in the inspection of cross-sectional metallographical specimens.

5. Polishing, and particularly buffing, closes up surface pores by a peening action and thereby provides a metallurgically denser or more impervious surface.

6. Most plating and inorganic and organic finishing must be preceded by preparatory polishing and buffing to obtain the high luster desired on the finished surface.

7. The reflectivity of radiant energy is increased by highly buffing the metallic surface in question. The emissivity of a matte surface is always higher than that of a highly specular one.

Mechanical Finishing Operations

Mechanical surface-finishing operations are classified as:

Grinding—An operation whose primary purpose is the removal of large amounts of stock from the work in minimum time so subsequent operations will not be overburdened. Applications for grinding are found in the removal of casting flash, weld protrusion, and on rough sections generally of castings and forgings. Wheels used are the typical grinding-wheel compositions operating at about 5000 to 6000 sfpm.

Polishing—A series of abrading operations following grinding but preceding buffing, wherein stock removal and preliminary surface smoothing are accomplished. Polishing is performed by abrasive belt or setup wheel or disk having the abrasive glued to the periphery. Polishing is further subdivided into roughing, dry fining, and finishing or greasing, the terms being identified by the size of abrasive grit and the presence or absence of a polishing lubricant.

Roughing uses no lubricant and employs coarse abrasives, usually 20 to 80 grit but differing somewhat for different metals. For aluminum, for example, the term roughing is applied to operations using up to 100-mesh abrasives. Dry fining uses finer abrasives without lubricants, the abrasives being usually 90 to 120 and sometimes through 150 to 180 grit. Finishing or greasing employs lubricants such as oil, beeswax or tallow compositions applied to finer abrasives, usually from 150 to XF grit.

Many different types of wheels are used for polishing, including:

Wooden wheels, constructed essentially of a large wooden hub whose periphery is covered with leather. The wheel has no resiliency and is applicable primarily to flat surfaces. Speeds of 7000 sfpm are typical for wooden wheels.

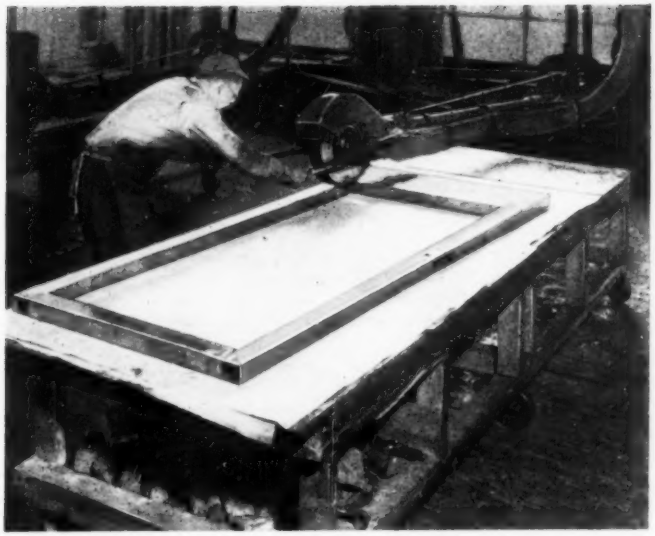
Compressed wheels. These are constructed of a steel center surfaced with leather, canvas, or linen. The construction is substantial and the wheel is durable and easy to keep in balance. It is an all-purpose wheel, safe, and more economical to use than the wooden wheel. Typical applications are on cutlery and chilled plows. Speeds of 7000 to 8000 sfpm are normal.

Canvas and muslin wheels are in the widest general use. They are constructed by sewing and glueing together individual sections for the hardest wheels. Softer wheels are constructed of muslin sections sewn together. Typical applications are found in the polishing of cast iron, steel, brass plumbing fixtures, stoves, plows, etc. They are versatile wheels, satisfactory for roughing and dry fining of irregular pieces as well as greasing where the more resilient wheels are employed. They hold the abrasive well and may be refaced without washing off, cleaning with a buff stick or abrasive brick being satisfactory. Speeds of 7000 sfpm are typical.

Sea horse wheels are very expensive but do excellent jobs on guns, pistols, cutlery, etc., where a high-grade job is required. Felt wheels are used generally in conjunction with the finer grits for dry fining or greasing.

Solid leather wheels are composed of walrus and bullneck leather. They are tough and resilient and find application in fine polishing of guns, cutlery, etc. An average rotative speed is 6000 sfpm.

Other wheels commonly in use are made from cloth, sheepskin, rubber, and flannel.



Swing-frame polishing lathes are widely applied to finishing large work which cannot be conveniently held by hand and when quantities do not justify building a special machine *Photo courtesy Philip Sievering, Inc., New York, N.Y.*

Abrasive Belts are endless belts used on a polishing machine in conjunction with a backstand idler. They run as high as 7000 sfpm and are being used more widely as more applications for them are uncovered. They run cooler than wheels and abrade more rapidly. The abrasive is scientifically applied under the influence of an electrostatic field so the points of the abrasive particles are always oriented upwards.

Brushing—An operation wherein the work is held against a metal wire or Tampico brush with or without an abrasive. It is used to remove rust and to provide special brushed or satin finishes. Frequently, brushing with a Tampico wheel and emery paste is used between final polishing operations and buffing. Brushes may go as fast as 12,000 sfpm.

Buffing—The final finishing operation. Its function is the removal of very small amounts of metal and the production of surfaces having highly specular or special satin or Butler finishes. It removes visible polishing scratches and leaves the surface looking very smooth and homogeneous. Buffing may be divided into three subdivisions:

Cutting, whose primary purpose is to remove the small amounts of metal required to provide the smooth surface for the final operations.

Coloring, which produces the high gloss or mirror surface. Frequently cutting and coloring are performed in one operation.

Satin finishing, which produces special satin or Butler finishes.

Wheels used for buffing are constructed of muslin sheeting, stitched or unstitched. Stitched buffs are generally employed for cutting, and unstitched or loose buffs, with or without spacers, for coloring. In buffing the compound is applied to the wheel as it rotates.

Ratio of Glue to Abrasive in Setup Wheels

GRIT SIZE	DRY GLUE % BY WEIGHT	GRIT SIZE	DRY GLUE % BY WEIGHT
30	50	80	33
36	45	100-120	30
46	40	150-180	25
60	35	220-240	20

Setting up Polishing Wheels

To set up a polishing wheel means to true and balance it, and apply and cement the abrasive.

The most widely used adhesive is animal hide glue and the highest quality glue is the most economical in the long run. The glue is prepared for use by dissolving ground glue by soaking in water in an aluminum or copper glue pot for at least 1 hr at 150 F. The concentration of dry glue will vary with grit size to be applied, the coarser the abrasive the higher the concentration of glue, as shown in the accompanying table. Glue solutions should be made up freshly each time they are to be used.

The most widely used abrasive for setup wheels is artificial alumina (aluminum oxide). Other abrasives are artificial silicon carbide and natural Turkish emery which contains oxides of iron as well as alumina.

For buffing, the following abrasives are used:

Tripoli—For cutting and coloring, particularly good on brass, aluminum, and zinc die castings.

Pumice—For brushed effects on Tampico wheels.

Crocus—This oxide of iron is quite hard and is used on cutlery steel as a coloring abrasive.

Vienna Lime — Soft compound used on copper plate, nickel plate, brass, and similar materials.

Rouge—Very soft compound producing the most lustrous-colored finishes on jewelry and fine work.

Chrome-oxide (green rouge)—Used on stainless steel, monel, and nickel as a coloring composition.

Alumina (white oxide)—Used for coloring monel and stainless steel.

Emery cake—Used on brushes after polishing and before buffing.

Setup Procedure

The procedure for applying the glue and abrasive to the polishing wheel is:

1—Dress and balance the wheel with a rake, buff stick, abrasive

stone or old hacksaw blade.
2—Heat the wheel to about 120 F in an oven.
3—Coat the warm wheel with a size coat of 25% glue with a brush. Coat sides and face.
4—Dry at room temperature for 2 hr and repeat sizing if desired.
5—Apply the glue solution prepared for the size grit to be used. The wheel should be at 120 F.
6—Roll the wheel in the abrasive which has been placed in a shallow trough.
7—Brush off loose abrasive.
8—Dry overnight at room temperature.
9—Repeat 5, 6, and 7.
10—Dry for 24 hr.
11—Balance the wheel and break up the abrasive surface, when resiliency is required, by striking the surface with a steel bar.

Wheels may be reclaimed, after the polishing head has been removed through service, by abrading off or soaking off the old head and repeating the above procedure.

The size of the wheel and its job application will determine the power expended in polishing. Average horsepower requirements are:
6-in. wheel requires ¼ hp
10-in. wheel requires 1 hp
12-in. wheel requires 2 hp
14-in. wheel requires 3 hp

Polishing wheels should be kept in perfect balance and should run true. Wheels which are not so maintained will not do the most efficient polishing job and will abrade away unevenly, resulting in a waste of glue, abrasive and time. Glue pots should be kept clean and sterile when not in use. The glue, abrasive, and wheel should be properly warmed before applying. Wheels should be kept clean and completely coated with abrasive at all times, and the correct wheel should be used for each job.

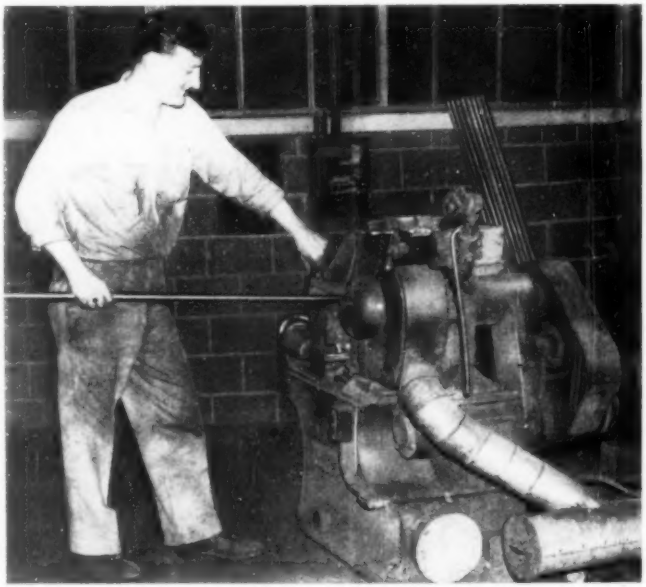
Hand or Automatic Polishing

THE oldest and still most widely used method of polishing and buffing is the hand-polishing method whereby an operator picks up each part and holds it against the spinning wheel. Modifications of this method include approaches whereby jigs and holders are used for securing one or many parts, and the polisher then holds the jig to the wheel and polishes its contents.

The machine most widely used is the dual-wheel polishing lathe mounted so its spindles are about 32 in. from the floor where the operator is seated and about 42 in. for standing operators. Productivity, using the hand-polishing method, will be at a minimum and will depend upon the speed and skill of the polisher where one piece is handled at a time. However, the use of multiple jigs has materially increased the value of hand polishing, and for some work, productivity by the use of multiple jigs is practically as high as on automatic machinery.

In one such example, a plating and polishing shop contracted to buff and nickel plate the mating legs of brass dividers and compasses. Total production involved about 500,000 legs. Polishers were able to cut with tripoli and color with lime beween 40 and 50 per hr, using the one-at-a-time method. Multiple jigs were designed so that when a polisher picked up a jig he was handling 22 to 42 legs at one time, depending upon the particular component. Productivity increased to 400-450 legs per hr, a figure which would compete favorably with the production of an automatic machine. The large initial investment represented by an automatic was thereby saved.

However, by and large, hand polishing cannot compete with automatic polishing which may effect labor savings of 40% to 90%. Today, many items are handled automatically at very low costs,



Automatic polishing machine effects tremendous increases in the production polishing and buffing of metal tubing, insures uniformity of finish, and lowers costs *Photo courtesy The Four Plating Co., Inc., Newark, N.J.*

Size and shape of the work largely determine the operator's position. Smaller parts can usually be handled without difficulty with the operator seated. Larger parts require a sanding position

Portable tools are widely used for polishing and buffing parts too large to be held by hand and whose shape does not lend itself to the use of swing-frame equipment

including automobile bumpers, hardware and accessories; heating iron shells and bases; flashlights, vanity cases and lipstick shells. It is interesting to note that one company was able to turn out 100 lipstick tubes per hr using a skilled hand polisher. The installation of an automatic tubular polisher raised production to 2000 per hr and required only one girl to feed and remove the work.

Installation of automatic polishing machines will depend primarily on the quantity of work involved. Even though the machine itself may be readily adaptable to a variety of different jobs, the setup time involved in making frequent change-overs may well offset the savings effected by automatic operation. Only when the relatively high initial cost of the equipment can be favorably balanced by substantially lower labor cost, over a period long enough to effect a total economy of operation, will automatic machines be fully warranted.

Automatic and semi-automatic mechanical surface-finishing machinery falls into three classes: The straight-line, the multiple-head, and the contour machine. Straight-line machines feed the work in at one end on a conveyor, the work moving in a straight line and being processed by a number of overhead wheels until, at the other end, the finished product is removed. Multiple-head machines are generally circular and provided with indexing devices so the position of the surfaces to be polished and the polishing wheel is synchronized for each operation. Contour machines have their applications primarily for internal or contour polishing and buffing.

Setups on Automatics

Automatic polishing, unlike hand polishing, requires a precision setup. The work must be contacted just right by all the wheels involved. There is no operator to look at each part after each wheel operation and touch up unpolished spots. When a part is unpolished on any area, it is a reject and must be fed through the machine again. This severely cuts into the cost-savings of the automatic setup.

To reduce the prevalence of such rejects the following precautions must be taken:

1. Choose the right type of machine for the job.
2. Where the polishing wheels are to be of several different diameters or where buffs are to be used (buff diameters decrease with wear), the machine should be chosen so there is provision for varying the speed of the wheel spindles.
3. The speed at which the work moves past the wheel or is rotated under the wheel should be capable of variation to compensate for the different surface characteristics of different metals.
4. Wheel pressures on the work should be capable of variation.
5. Where flat or cylindrical surfaces are involved, the machine should be capable of side-to-side sweep as well as transverse movement. This simulates the hand-polishing technique and provides smoother, less scratchy surfaces than a unidirectional movement.
6. The machine should be dynamically balanced and free from vibration.
7. The design and construction of jigs must be good. They must hold the work securely, be easily loaded and unloaded, free from mechanical movements which wear or go out of adjustment, designed so that the wheel will always contact the work in the same manner, be removable when interchanging is required, and where portable, must be locked into the machine securely during operation.

Operating Procedures

DIFFERENT types of materials necessarily require different polishing and buffing techniques and the application of different grades of abrasives. This will depend on the hardness of the metal and upon the amount and nature of the operations that have already been performed. Methods may vary in individual shops, and the skill and experience of the operator may enable him to obtain results not normally to be expected from the equipment and compounds in use. Such displays of craftsmanship are usually time consuming and should not be countenanced in a production plant.

The procedures outlined here are based on practical experience and will be found to produce satisfactory results.

Monel and Nickel

Grinding may be required on castings, and rubber-bonded wheels are employed. Light welds can be ground with a 36-grit and heavy welds with a 24-grit wheel. Wheel speeds are about 8000 to 9000 sfpm.

For roughing and dry fining, wheels composed of 64x68-count unbleached cotton fabric sections glued together are satisfactory. For greasing, a 88x88-count heavy sheeting wheel or a full disk quited sheepskin wheel is adequate. Typical wheel speeds are 6500 to 7500 sfpm.

Cutting is performed with stitched or loose wheels at 8000 to 9000 sfpm and coloring with loose-disk canton flannel wheels at 10,000 sfpm using aluminum oxide, or chrome-oxide coloring compounds.

Brushing with Tampico wheels at 3000-6000 sfpm can employ emery cake before buffing, emery paste for satin or scratch-brush finishes, or pumice and water or pumice and oil for Butler finishes.

For cold-rolled sheets where a very good, bright, almost mirror finish is required, the sheets may be processed:

1. 180 emery, dry
2. 180 emery, greased
3. 200 or 220 emery, greased
4. Cut with tripoli
5. Color with aluminum oxide
6. Clean with whiting

Deep-drawn shells may be handled:

Good finish

1. 120 emery
2. 150 emery, greased
3. 180 emery, greased
4. Cut with tripoli
5. Color with aluminum oxide
6. Clean with whiting

Better finish

1. 150 emery
2. 180 emery, greased
3. 200 emery, greased
4. Brush on Tampico wheel
5. Buff with tripoli
6. Color with aluminum oxide
7. Clean with whiting

Light-gage welded equipment:

Good finish

1. Grind weld with 24 or 36 wheel
2. 80 emery over weld
3. 120 emery
4. 180 emery
5. 180 emery, greased

Mechanical Surface-Finishing Operations for Monel Metal and Nickel

	PROCESS	GRIT	TYPE OF WHEEL	SFPM	COMPOUND	FINISH
	Grinding	24 or 36	Rubber-bonded grinding wheel	8000 to 9000		
POLISHING	Roughing	60 or 80	Cotton fabric sewed sections glued together to give desired width. Soft cushioned face.	6000 to 7000		Rough grind
POLISHING	Dry Fining	100 or 120	Same as above	6000 to 7000		Commercial grind
POLISHING	Greasing	150 or 180	64 x 68 unbleached spiral sheet sewed and glued together	6000 to 7500	Tallow or 180 emery cake	Fine grind
POLISHING	Grease Coloring	200 or 220	88 x 88 sheeting sewed and glued	6000 to 7500	Tallow or F emery cake	Fine scratch finish
POLISHING	Grease coloring	200 or 220	88 x 88 loose spiral sewed or loose disk wheel	6000 to 7500	F emery cake	Fine scratch finish
BUFFING	Cutting		88 x 88 unbleached spiral sewed sections or loose disk wheel	8000 to 9000	Tripoli	Bright
BUFFING	Coloring		Same as above	10,000	Aluminum oxide (white)	Bright
BUFFING	Coloring		Same as above	10,000	Chrome oxide (green)	Mirror
	Brushing		Tampico	3000 to 6000	F emery cake	Scratch brush satin
	Bobbing or Sanding		Walrus leather wheel	5000	"Grout"	
	Lea Type		Same as for "Buffing"	5500	Lea N	Satin
	Wire Brush		Monel metal wire brush	4000 to 6000	Pumice and water	Wire brush satin
	Bobbing		Walrus leather wheel	5000	Pumice and oil	Butler satin

(Courtesy International Nickel Co.)

6. Tampico brush and emery cake
7. Cut with tripoli
8. Color with aluminum oxide
9. Clean with whiting

Rough castings would be handled:

1. Grind
2. 80 emery
3. 120 emery
4. 150 emery
5. 180 emery, greased
6. Tripoli
7. Aluminum oxide
8. Whiting

Stainless Steel

Stainless steel should never be polished with abrasives containing iron compounds. Imbedding of the iron-bearing grit may tend to start corrosion. Artificial aluminum oxide (alumina) abrasives are used. Cutting compounds include aluminum oxide and tripoli, and coloring compounds include aluminum oxide and green rouge.

On stainless steel sheet products where a mirror finish is desired, the following may be employed:

1. 90 grit
2. 120 grit
3. 180 grit, greased
4. 200 or 220 grit, greased
5. Cut
6. Color with aluminum oxide
7. Clean with whiting

For high color on small stampings:

1. 120 grit
2. 120 grit, greased
3. 180 grit, greased
4. Cut
5. Color with aluminum oxide
6. Clean with whiting

Forged golf-club heads:

For satin finish

1. 120 grit, greased
2. 150 grit
3. 180 grit, greased
4. Cut
5. Tampico wheel with pumice and oil

For mirror finish

1. 120 grit
2. 120 grit, greased
3. 150 grit
4. 180 grit, greased
5. Cut
6. Color with aluminum oxide
7. Clean with whiting

Steels (except Stainless)

Steel is polished at between 7000 and 7500 sfpm, and, depending upon the initial surface, can em-

Mechanical Surface-Finishing Operations for Stainless Steel

	PROCESS	GRIT	TYPE OF WHEEL	SFPM	COMPOUND	FINISH
	Grinding	36 60	Rubber or Bakelite bonded abrasive wheel	7000 to 8000		
POLISHING	Roughing	80	Soft cotton fabric sewed sections	7000 to 8000		Rough grind
POLISHING	Greasing	100	Same as above	7000 to 8000	Tallow	Grease finish
POLISHING	Greasing	120 150	Same as above	7000 to 8000	Tallow	No. 4 Grease finish
POLISHING	Greasing	180	Same as above	7000 to 8000	Tallow	Base for No. 7 grease finish
POLISHING	Greasing	220 240	Same as above	7000 to 8000	Tallow	Base for No 8 grease finish
BUFFING	Cutting		Bias or pocket buff	10,000 min.	Aluminum oxide	Bright No. 8
BUFFING	Coloring		Loose disk or Canton flannel wheel	9000 max.	Aluminum oxide	Bright No. 8
	Brushing		Tampico brush	5000 max.	Pumice with kerosene or oil	No. 6
	Lea Type		Bias or pocket buff	5000 max.	Lea E	Butler
	Wire B rush		Stainless steel brush	5000 max.		Wire brush satin

Mechanical Surface-Finishing Operations for Steel

	PROCESS	GRIT	TYPE OF WHEEL	SFPM	COMPOUND	FINISH
	Grinding	24 36 60	Bonded abrasive wheel	7000 to 8000		
POLISHING	Roughing	60 80	Cotton fabric sewed and glued together	7000 to 7500		Rough grind
POLISHING	Dry Fining	100 120 150	Same as above	7000 to 7500		Smoother ground finishes
POLISHING	Greasing	120 150 180 220 240	Same as above	7000 to 7500	Tallow	Fine ground to grease finishes
	Brushing		Tampico	5000	180 emery cake	Satin or scratch brush
	Lea Type		Bias buff	5000	Lea C or B	Satin
	Wire Brush		Steel wire brush	5000		Wire brush
	Coloring		Cotton buff, loose or stitched	8000 to 9000	Aluminum oxide or Chrome rouge	Bright

Mechanical Surface-Finishing Operations for Aluminum

PROCESS		GRIT	TYPE OF WHEEL	SFPM	COMPOUND	FINISH
Grinding		24 to 50	Phenolic resin-bonded abrasive wheels	8000	Dry or tallow or lard oil	
POLISHING	Roughing	60 to 100	Cotton fabric sections sewed and glued together	6000	Dry or with tallow or tallow and lard oil	Rough grind
POLISHING	Greasing	100 120 150 180 200 220	Felt or sheepskin	6000	Tallow, oil, or beeswax	Fine grind to grease finish
BUFFING	Cutting		Muslin sections, stitched or loose	7000 to 7500	Tripoli	Bright
BUFFING	Coloring		Loose low-count muslin sections with or without spacers	7500 to 8000	Soft silica	Bright to Mirror
Scratch Brush			Brass, stainless steel, nickel or German silver wire wheels	5000		Scratch brush or Scratch brush satin
Brushed			Tampico	5000	Pumice and oil	Satin

(From "Finishes for Alcoa Aluminum" published by Aluminum Co. of America)

ploy any of the polishing operations through buffing. Steel is rarely color buffed. Where a high color is required, the steel is usually plated with nickel and chromium or copper, nickel and chromium, the copper or nickel being color buffed with lime.

Castings or forgings may require:

1. 60 grit
2. 120 grit
3. 180 grit, greased
4. Tampico brush with 180 emery cake.

Stampings may require:

1. 150 grit
2. 180 grit, greased
3. 220 grit, greased or Lea type greaseless

Finishing Brass

Brass stampings and screw-machine products are generally buffed directly. The procedure uses muslin buffs, stitched or unstitched, with tripoli for cutting and lime or rouge for coloring. Wheel speeds are about 8000 to 10,000 sfpm.

For castings, setup wheels or belts should be used before buffing, at about 6800 sfpm. The casting must be analyzed first to determine whether it would be better to polish it on a wheel or a belt. If the piece has irregular, curved, or rounded surfaces, a setup wheel is probably better, flat surfaces being reserved for belt operations.

A typical polishing procedure for a half-hard brass casting would be:

1. 80 grit
2. 120 grit
3. 180 grit, greased or with emery cake
4. Cut with tripoli
5. Color with lime or rouge

Satin and wire-brush finishes are available with the Lea C greaseless type compound or brass wire brushes.

Zinc Die Castings

Die castings usually require only grinding or polishing to remove parting fins and lines, and gate stubs. Polishing wheels used for this purpose may be constructed of cotton fabric sections sewed and glued together, although felt, sheepskin and others are also used. Operations will include 120-grit and 180-grit dry or greased. The final operation is frequently performed on 200 to 240 greased wheels at about 8500 sfpm.

Buffing is best done using tripoli on muslin wheels at 8500 sfpm. Coloring employs cloth wheels and uses a soft silica type compound. Frequently cutting is done with tripoli, and coloring with a dry wheel which removes the residual tripoli and leaves the surface cleaner for plating.

Finishing Aluminum

Aluminum may be ground, polished, buffed and brushed. Buffing employs tripoli and soft silica for coloring, and polishing utilizes setup emery-coated wheels. Sheet aluminum products such as cooking utensils do not generally require polishing. Cutting with tripoli and coloring with soft silica is usually sufficient for the production of a mirror finish.

Screw machine products may be buffed only, or where machining lines are deep the steps may be:

1. 180 to 220 grit, greased
2. Cut with tripoli
3. Color with soft silica

Die castings may be handled:

1. 100 grit, greased
2. 150 grit, greased
3. Cut with tripoli
4. Color with soft silica

When the die-casting is particularly smooth, one or both polishing operations may be omitted.

Sand Castings may be handled:

1. 80 grit
2. 120 grit, greased
3. 180 grit, greased
4. Cut with tripoli
5. Color with soft silica or lime

Miscellaneous Metals

The soft plastic metals such as white metal, slush metal, pewter, antimonial or tin lead, and other lead-base alloys require slower polishing, between 5000 and 6500 sfpm, with finer abrasives lubricated with tallow. The wheels should be soft and resilient. Generally, however, cutting with tripoli will be sufficient as a first cutting-down operation. In the buffing operations, the wheels should not be held against the lower melting alloys for too long at a time or local melting will result.

More on Files . . .

BY D. L. LESLIE, Birmingham, Mich.

SIR: Regarding Mr. Grant Loader's article, "How to choose and use files" (AM, May 5):

After using files for 30 years, I feel that friendly comment on this article is in order.

Mr. Loader recommends the use of a new or sharp file on brass first and when the file dulls then use it on other materials. My files cut better when they are half worn out than when they are new, because then the teeth are all working, while at the start only about half of the teeth are working, as they are higher. A file cuts equally well on steel, cast iron, brass, babbitt, or even plastic materials if the proper file is chosen to do the amount of work required. If a lot of material is to be removed, then we choose a coarse file; if the job is large then we use a large file, when we near the finish then we use a finish or smoother file.

We can use a float file if one of suitable size is available at the start of the job, then finish with a file of finer cut.

Sheet-Metal Filing

Filing of sheet metal can be done with a coarse file to start, if you approach the job properly. For roughing, the work is vertical and the file should be held so as to cover as wide a surface as possible. The stroke is along the edge, as the metal will have less bending in this way. For semi-finishing, lay the work flat on the bench with the layout line near the edge, and clamp it down firmly. Hold the file handle between the thumb and forefinger of the right hand, and the point between the thumb and finger of the left hand. With the point down, lean forward until the handle points over the right shoulder. In this way the worker can see the layout line at all times. The angle can be varied to suit the worker and is important in that material is still on the part for the finish when the edge is squared. If the layout is accurate, the worker can file to as close as ± 0.002 in.

For finishing, the work is again held vertically, and if a square edge and accurate size are required, it is advisable to use a file block.

Many times I start a flat surface with the rounded side of a half-round file, using a slight rolling motion as the file crosses the work.

Lathe filing is something that comes very easily after you first learn to use the file at the bench.

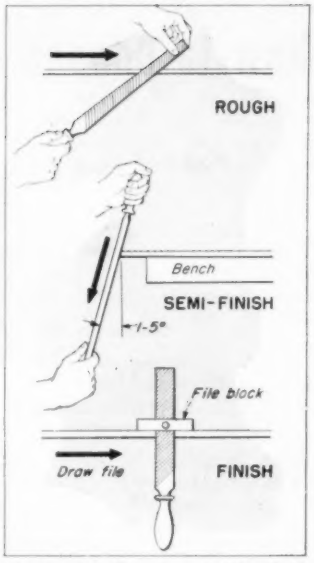
The Stance

Please, Mr. Loader, the stance. You want to take the filer home in a wheel chair after 8 hours' filing? And gripping the file! Afraid it is going to get away?

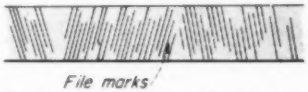
Take the file lightly between the thumb and forefinger of the hands, the one hand being near the tip and the other hand near the head of the shank (you can change hands from time to time as you desire). And keep your dirty hands off the file where you want it to cut, as the oil and dirt from your hands will make a film on the cutting edges of the file and make more labor of the filing. Now lay the file lightly on the work and balance it to the surface you wish to file. If the work is out of square and you wish to square it, bear this in mind. Until now a co-worker should be able to take the file from your grasp with one hooked finger.

Relax and put your big feet anywhere they are comfortable.

When you have the feel of the work surface, and the stance, and now the grip, apply about ½ lb pressure, evenly on the file. Don't shift the pressure from toe to heel. Don't bend the file. Make the strokes forward, at the longest stroke convenient to the reach, file length and work. Keep your dirty hands off the surface to be filed at all times. This is important. Lift the file on the return stroke enough to clear the work. You won't cut much 'til you get the film of oil off and get down to the bare metal. A slight occasional change in the direction of the stroke across the work will give you guide lines to help you file evenly and tell you if you are removing stock where you desire.



Sheet-metal filing is not difficult if properly performed in three steps



Changing direction occasionally during filing will give lines to check where stock is being removed

We use chalk on the file and work, but we use it to dry the file of grease, oil or moisture so the chips won't stick. We use a graphite pencil also on the work if we have a few big spots we want off, so we know where the file is working. We use a dry clean paintbrush to clean the work during filing and we use a file brush or card to clean the file.

If we respect our files for what they are, cutting tools, we place them separately in wooden pigeon holes or compartments when not in use, and lay them out separately on the bench when we wish to use them.

Filing can be a normal task or a lot of hard labor, but when it is a lot of labor it is usually being done wrong.

How to Choose and Use PORTABLE TOOLS

PART 7 . . . AIR POWER DISTRIBUTION

Most frequent cause of trouble with air tools is insufficient pressure, caused by undersize main and downpipes and hose

BY H. P. BAILEY, President, THE ROTOR TOOL CO.

THE importance of the power-distribution system in delivering power from an air compressor or frequency changer through the plant to the individual tool is often underestimated. If the system is inefficient, steady losses occur over the life of the entire system without any offsetting gains. On the other hand, it is entirely possible to check any form of power distribution and remedy any defects, and, once the system is corrected, future losses are avoided.

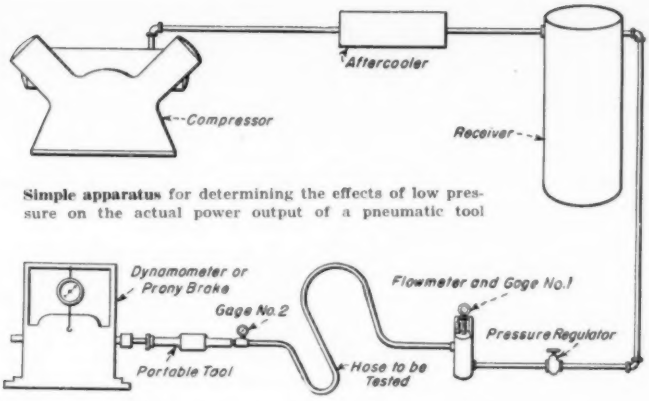
How to determine the actual pressure delivered to the tool while it is running was a difficult problem until the development of hypodermic-needle air gages, such as the Rotor needle pressure tester. This device consists of an air gage with an adapter and a standard hypodermic needle. The needle is inserted into the hose near the tool itself, with the hose bent so that it will go in and out easily. The pressure is read while the tool is operating at full load. The fact that the hose up to the tool, with the tool shut off, shows 90 psi means nothing. When the air consumption of the tool lowers the pressure, the exact pressure delivered to the tool running under load may be disclosed easily. There may be a further restriction in the nipple at the end of the hose between the pressure tester and the tool itself, but from a practical basis a complete check can be made in a few minutes on a variety of tools to show exactly what pressure is available while the tool is running.

Needle pressure tester inserted into the hose will indicate the pressure at the tool when running under full load, which is the only figure of any real value

The output of portable tools and air-driven devices of most types is governed by the pressure. If pressure is down, the output in the form of work performed is seriously restricted in about direct proportion to the drop in pressure (except in the case of reciprocating tools, such as chipping hammers, where the drop in power is much faster than the drop in air pressure). Moreover, if the drop is greater than half, the tool may not run at all.

Factory executives will readily admit the seriousness of loss in efficiency due to loss of air pressure, but many fail to recognize that the air pressure on the compressor gage does not indicate the air pressure actually delivered to the point of use. The impression is quite common that if the compressor shows 100 psi, the pipe where the hose goes on will also be very close to 100 psi.

Another misconception about air pressure relates to the method of testing. A gage may be on the downpipe, which again shows a pressure only at that point and not at the entrance to the tool. Sometimes, the air gage in the downpipe may be read when the air is not flowing, which will give a fictitiously high static pressure. Or, sometimes air gages are connected on the end of the hose with the tool disconnected. This again will show static air pressure, not the



Simple apparatus for determining the effects of low pressure on the actual power output of a pneumatic tool

pressure available while air is being consumed in the tool—a difference which in most cases is quite substantial.

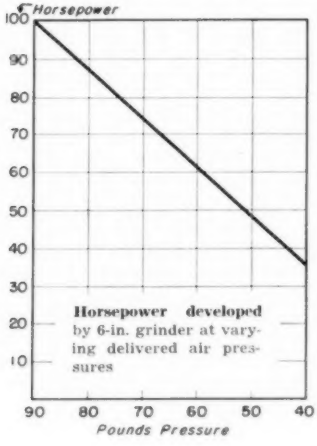
If a needle-gage pressure tester is not used, other methods are available which are not quite so convenient. An air gage may be connected to a nipple between the end of the air hose and the end of the tool. If this gage is read while the tool is operating, the correct pressure will be shown. The average pressure shown by a large number of tests under actual operating conditions is quite frequently down to 60 to 65 psi, even in fairly well engineered installations, and it is not at all uncommon to find pressure as low as 45 to 55 psi. Sometimes the pressure is reasonably good during part of the day, but when sandblast or other equipment is in operation the pressure drops substantially.

Results of Low Pressure

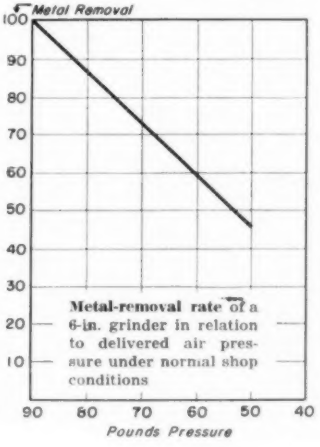
The following procedure is outlined where companies wish to determine for themselves exactly what happens to production under low air pressure. The accompanying sketch shows an arrangement which can be easily rigged to determine the effects of low pressure, including a regulating valve which will duplicate the low pressure produced by drops in the line, hose, nipples, etc, provided actual pressure of, say 90 psi is available. The sketch shows an ample supply of air running through a regulator, then through a flowmeter to show the amount of air consumed, with a gage which shows the pressure. The hose is attached to the tool which in turn is attached to a prony brake or dynamometer. In this way the horsepower output of the tool can be determined at a wide variety of pressures on gage No. 2. In the case of practically all abrasive air-tools it will be found that the horsepower drops in rough proportion to the drop in air pressure, and in addition, in tools where speed is a factor, the rpm at which the power is developed will also drop.

It is also possible to test the actual metal removal at various pressures on gage No. 2. In this case, a standard test bar of SAE 1020 steel is weighed, and three 5-min grinding tests are run to show the amount of metal removed at each different pressure. At times there are some variations in charted curves produced, because grinders in a factory are usually somewhat overpowered and a small drop in pressure, say from 90 to 80 psi, will not show much of a drop in metal removal under practical shop conditions. At the other extreme, however, when the pressure gets down to 55, 50, or 45 psi, there will often be a sudden, rather sharp, drop in metal removal because the power is not sufficient to turn the wheel over at anywhere near a workable speed.

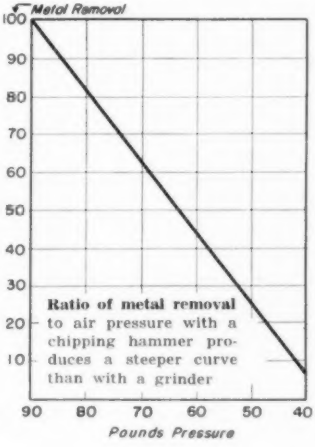
Here is an example of the re-



Horsepower developed by 6-in. grinder at varying delivered air pressures



Metal-removal rate of a 6-in. grinder in relation to delivered air pressure under normal shop conditions



Ratio of metal removal to air pressure with a chipping hammer produces a steeper curve than with a grinder

sults of practical shop tests: A midwestern fabricating shop was operating a vertical, cup-type air grinder with flared wheels and had 95 psi on the main line. However, the pressure at the grinder, as shown by the needle pressure tester, was only 60 psi. Further investigation showed that this was because the ½-in. hose was too small for the length involved, and ¼-in. nipples and hose menders choked off the pressure. A simple substitution of lightweight, flexible ¾-in. hose and ½-in. nipples increased pressure at the tool to 85 psi and cut grinding time 40%.

In the case of reciprocating tools such as chipping hammers, it will be found that if the tool is tested under maximum load and the air pressure is reduced, the metal removal will drop faster than the air pressure, and at a point of about 40 to 45 psi the tool will hardly function. Unfortunately, when the horsepower is dropped in a portable tool, not only is the power of the tool reduced, but the sfpm is reduced, and particularly in connection with all forms of abrasive tools, the cutting action goes down very rapidly as the speed under load is reduced, so the cost of grinding wheels or sanding pads runs up very rapidly.

Methods of determining metal removal for chipping hammers are, of course, not as certain as in the case of abrasive tools or drills, because the only way to develop metal-removal figures is with the standard Navy testing machine where the tool is held with a fixed pressure, not operated by hand. Such tests will show varying metal removal between light, medium and heavy chippers, and cannot be regarded as highly accurate. They do however give definite indication of the work done by the hammer. At the same time they do not express quite accurately the loss in cutting ability at lower pressures because the hammers are then often difficult to handle and control and sometimes do not have enough power actually to remove a chip.

Remedies for Low Pressure

Where pressure at the tool is found to be inadequate, this procedure is suggested:

First. Check the gage on the compressor and see that the unloading valves are set at 90 to 100 psi, and that the gage on the compressor is accurate.

Second. Check the size of the piping from the compressor to the point of operation. Examination of many air distribution lines shows that they are often computed on the narrow side, and if additional air capacity is added they are not enlarged. As a matter of fact, when pipe is installed, the cost of the next larger size is largely limited to the extra cost of the pipe itself. After a period of years, pipes tend to restrict themselves through an accumulation of rust and dirt, particularly where aftercoolers are not used. In general, however, the main lines in most plants are of pretty fair size and the first restriction usually occurs in the downpipes. However, if the main pipe is restricted, the practical remedy is usually to loop the line, that is, run another pipe from the compressor to the main point of distribution, as this is usually cheaper than tearing out the old pipe and putting in the new one. Then downpipes should be checked because the downpipe was perhaps originally supposed to supply only one or two tools. It may be found that now maybe four or five tools are used, and the size should be increased. Valves also should be given attention, because they invariably afford some restriction and this should be minimized to the best extent possible.

Accompanying tables show how to figure the correct sizes of pipe for main and down lines. First determine the number of cfm of air used through the main line. Then find the total length of the main line and consult the table. If the main line is 500 ft long and the flow is 250 cfm, a 1¼-in. line will

How to Figure Correct Pipe Size for Main Air Lines

Pressure drop in	1¼-IN. MAIN LINE		1½-IN. MAIN LINE		
when air consumption is	250 cfm	100 cfm	500 cfm	250 cfm	100 cfm
through the following length of pipe					
100 ft	4.0	0.7	*7.1*	1.8	0.3
200 ft	*8.0*	1.3	*14.2*	3.6	0.6/
500 ft	*20.2*	3.3		*8.9*	1.5
1000 ft	*40.4*	*6.5*		*17.9*	2.9

Pressure drop in	2-IN. MAIN LINE			2½-IN. MAIN LINE		
when air consumption is	700 cfm	500 cfm	250 cfm	700 cfm	500 cfm	250 cfm
through the following length of pipe						
100 ft	3.8	1.9	0.5	1.5	0.8	0.2
200 ft	*7.5*	3.8	1.0	2.9	1.5	0.4
500 ft	*18.8*	*9.6*	2.4	*7.3*	3.8	1.0
1000 ft		*19.2*	4.8	*14.5*	*7.5*	1.9

Pressure drop in	3-IN. MAIN LINE			4-IN. MAIN LINE		
when air consumption is	1500 cfm	1000 cfm	700 cfm	2000 cfm	1500 cfm	1000 cfm
through the following length of pipe						
100 ft	2.1	0.9	0.5	0.9	0.5	0.2
200 ft	4.0	1.9	0.9	1.8	1.0	0.4
500 ft	*10.5*	4.7	2.3	4.4	2.5	1.1
1000 ft	*21.0*	*9.3*	4.6	*8.8*	4.9	2.2

Note: **Figures in italics indicate excessive pressure drop**

How to Figure Correct Pipe Size for Down Pipes

Pressure drop in	¾-IN. DOWNPIPE		1-IN. DOWNPIPE		
when air consumption is	100 cfm	50 cfm	150 cfm	100 cfm	50 cfm
through the following length of pipe					
25 ft	2.5	0.6	1.6	0.7	
50 ft	5.0	1.2	3.2	1.4	
75 ft	*7.5*	1.8	4.7	2.1	0.5
100 ft	*10.0*	2.5	*6.3*	2.8	0.7

Pressure drop in	1¼-IN. DOWNPIPE		1½-IN. DOWNPIPE	
when air consumption is	200 cfm	150 cfm	400 cfm	250 cfm
through the following length of pipe				
25 ft	0.7	0.4	1.1	0.5
50 ft	1.3	0.8	2.3	0.9
75 ft	2.0	1.1	3.5	1.3
100 ft	2.6	1.5	4.6	1.8

Note: **Figures in italics indicate excessive pressure drop**

show a pressure drop of 20.2 psi, which is too much. Referring to the next column, a 1½-in. line will show a drop of 8.9 psi, which is not too bad but not good enough for an efficient installation. The 2-in. line shows a drop of only 2.4 psi, and is, therefore, the size to be used.

To use the table for downpipes, determine the number of outlets in operation at any one time, and thereby determine the number of cu ft to be drawn through the pipe. For example, if four heavy-duty grinders are to be used at the same time, each consuming 40 cfm, the required flow is 160 cfm. If the downpipe is less than 25 ft long, the pressure drop at 150 cfm would be 1.6 psi. This may be satisfactory, but the 1¼-in. pipe would be better, as the drop is only 0.4 psi.

The main difficulties in air power distribution systems, however, lie mostly in the hose between the valves and the tools. In the past, compressed-air hose has been rather heavy, which has tended to keep down the size. While whips are sometimes used in the last ten or fifteen feet, much of the hose today is definitely on the small side. Wartime hose also proved notoriously weak in length of life and the inside often disintegrated, and, in turn, restricted the true size of the ID. Moreover, nipples are necessarily inserted into the end of the hose and always provide a restriction, or an area less than the area of the inside of the hose. The use of hose menders is a particularly vicious practice because usually ¼-in. pipe is used in ½-in. hose, which restricts the hose to about ¼ in. If a needle pressure tester is put in the end of the hose near the pipe line, then put in the end of the hose near the tool, the restriction in the hose itself will become obvious.

The situation requires a periodic checkup because of changes in practical shop operations, particularly in connection with hoses, hose menders, nipples, quick-detachable couplings, and additional tools. Air pressures are often found to be ridiculously low, and regardless of the particular tool used, the production output is reduced unnecessarily. Occasionally, when the situation is discovered, the objection is raised that providing the proper air lines and hose will increase the cost of air. The importance of providing the proper air pressure in this respect is shown by the following figures*:

"If ten men operate pneumatic tools 8 hr a day, with labor and overhead costing $2 per day, their time will cost $2x10x8 = $160 per day. If their output can be increased only 10%, by improvement in the air supply, the savings on the ten men will be 10% of $160 or $16 per day. If ten tools consume an average of 30 cfm under poor conditions, assume that the consumption would rise to as high as 45 cfm to develop full power and realize the 10% additional production indicated above. This would mean:

15 more cfm × 10 tools = 150 additional cfm at full use.

If the tools are in use half the time, the actual extra air required is 150 cu ft × 50%, or 75 cfm. This additional air would cost:

75 cfm × 60 min = 4500 cu ft per hr

At a cost of 5¢ per 1000 cu ft = 22½¢ per hr

Or, for 8 hr = $1.80

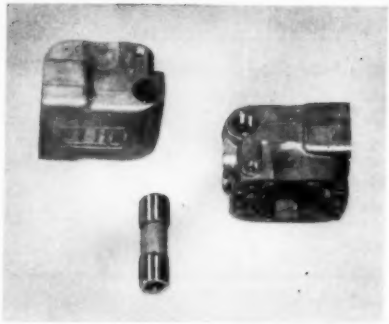
This contrasts with savings of $16 per day on labor."

This type of analysis applied to an individual situation often clears the air and removes the limitation in the minds of factory supervisors as to the desirability of really clearing up a situation and getting maximum production from the air compressor and the tools already at hand.

Fortunately, the remedy for low pressure is fast and simple. Hose is available today in a lightweight form so a ¾-in. hose, flexible, treated chemically inside, etc, is actually lighter and easier to handle than older types of ½-in. hose. A simple replacement of ordinary ½-in. hose, say 50 ft long, even if in fairly good condition, with the new ¾-in. hose will show up in a great many cases immediately and directly in the visible output of the tool. The newer hose costs somewhat more than the older, but on the other hand, justifies this by longer life. It is also possible to expand the use of leader lines to the last 8 or 10 ft, in many cases, as a partial remedy.

(Part 8 of this series will appear in a forthcoming issue—Ed.)

*Compressed Air Handbook. Copyright, 1947, Compressed Air and Gas Institute.



Shrink fitting brass sleeves into zinc die-cast oil burner pump housings. Pumps are cleaned in steam bath which raises temperature to 180 F, and placed on simple bench fixture. Sleeves are ground to 0.8760 to 0.8765 in. OD, and holes in housings are 0.874 to 0.875 in. in dia

Photographs Courtesy The Linde Air Products Company

NITROGEN ASSEMBLES PUMPS FASTER

Shrinking the shaft by cold, rather than forcing it in by press, saves Tuthill trouble in making assemblies

BY E. M. VOELKER, Superintendent, TUTHILL PUMP COMPANY

ASSEMBLY of small shafts into gears and pump rotors, and of brass sleeves into housings for domestic oil-burner pumps, has been simplified at Tuthill Pump by replacing arbor presses with liquid nitrogen cooling equipment. Resulting expansion-fitting procedures have a number of advantages. Grinding of gear-and-shaft or rotor-and-shaft assemblies on centers has been eliminated, because the shafts now can be centerless-ground to size before assembly. Distortion of the small shafts because of press assembly pressures has been eliminated and the resulting joints are stronger because metal is not shaved from the bores of gears and rotors when shafts are pressed in place.

For the larger shaft-and-rotor assemblies for some sizes of hydraulic pumps, the liquid nitrogen procedure offers an additional advantage because assemblies now can be salvaged when shaft or rotor is damaged in assembly or in the field. Previous assembly method consisted of butt welding the shaft to the rotor, and the percentage of rejects was high when the welding operation was not watched carefully. Now, these assemblies can be salvaged by heating the rotor and pressing the shaft from its bore.

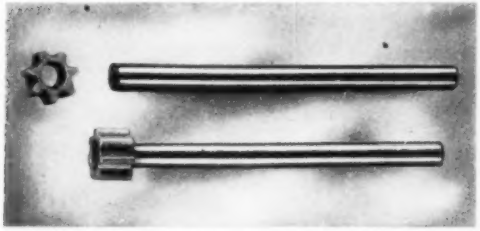
For making expansion fits with liquid nitrogen, the inner parts (shafts or sleeves) are cooled to approximately —320 F in an insulated bucket, into which the liquid is poured from standard containers. Outer parts remain at room temperature, or are heated with hot water or steam. Small parts, such as shafts and bushings, are held in a small basket in the insulated bucket, while larger shafts

Glass wool insulation between inner and outer walls of cooling bucket reduces loss of nitrogen during cooling cycle. Small pieces are placed in perforated metal basket and lowered into bucket before liquid nitrogen is poured in. Bucket is covered with cloth and wood lid to minimize evaporation. Parts are allowed to cool 2 min or longer. This reduces their temperature to about -320 F

are placed directly into the inner well of the bucket.

Accompanying photographs show principal steps in making three assemblies. Simplicity of equipment needed for these operations should be noted, as well as the speed with which the operations can be performed. By selecting job lots to make the most economical use of the liquid nitrogen, cost of the operation is kept within reasonable limits.

For example, a 5-liter container of liquid nitrogen is sufficient for about 200 sleeve-and-oil-burner-pump-housing assemblies or for 1000 small shaft-and-gear assemblies.



Centerless ground shaft 0.3110 to 0.3112 in. in dia is fitted into 0.3100 to 0.3105-in. bore of 7/16-in.-long gear. Assembly must withstand 17 in.-lb torque test

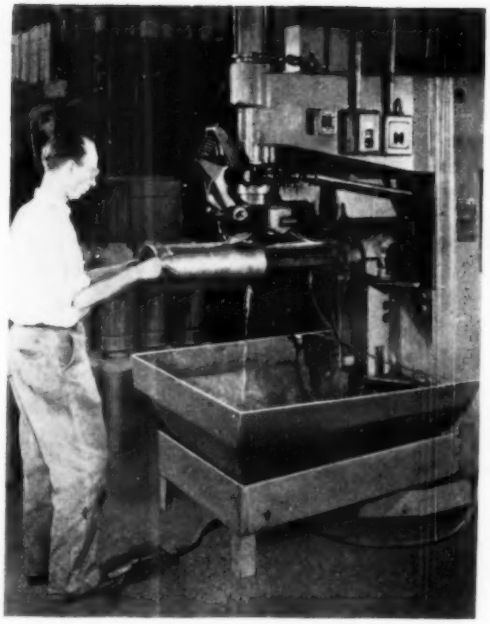
Basket holding cooled shafts is supported on its handle leaving 1 in. of shaft in liquid nitrogen. Assemblies are immersed in oil to return to room temperature

Oil-pump rotor shafts are cooled for 15 min in bucket of liquid nitrogen, and are removed one at a time for assembly into rotors which have been washed in hot water and heated to 180 F. Operator must wear gloves because contact of bare hand with cold shaft results in a severe burn

Chilled shaft is pushed into rotor to a fixed stop and held in position for 10 to 12 sec. Depth of entry is 0.530 to 0.533 in. Assemblies are torque tested to 300 to 350 in.-lb and not one failure has occurred. Nitrogen consumption is 25 liters for 21 shafts

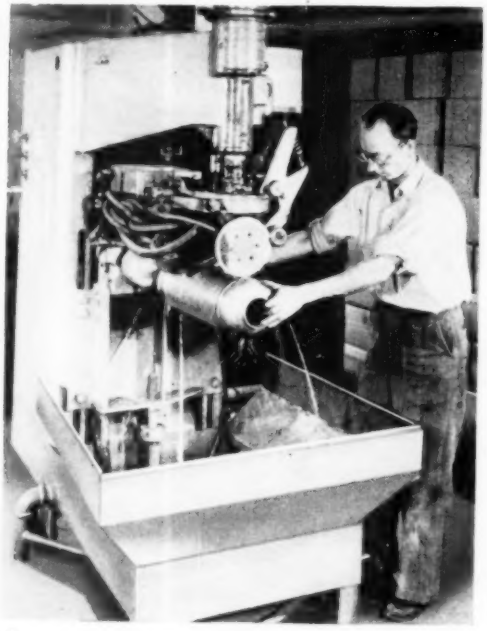
Welding Makes Lower Cost Shells

THERE are cases in which fabrication by welding is cheaper than deep drawing. Example is the new 2½-gal. stainless-steel fire extinguisher made by Fyr-Fighter Company. Formerly, this manufacturer used drawn copper and silicon bronze. But by shifting to a stainless-steel tank fabricated in three parts—a body rolled from a flat blank, a dome, and a bottom piece—weight is reduced one-third, strength is 25% greater, and cost is reduced. Greater corrosion resistance is obtained by use of 18-7 and 18-8 stainless steels, which are unaffected by the heat of welding.



1... Extinguisher body is rolled from flat stainless, tack-welded on spotwelder, then seamwelded with a special mandrel as shown

2... Top dome is seamwelded to tack body with conventional circular seamwelder equipped with an upper wheel drive. The dome is drawn from flat stock



3... Bottom stamping telescopes into tank body, is tack-welded in position, then seamwelded to form a gas-tight joint. Bottom stamping is concave and flanged

ROUND TABLE

Blowing Off Steam

"Ed, I wasn't eavesdropping, understand, but I couldn't help overhearing the remark you just made to Reynolds about Billings."

"I just had to get something off my chest, Al. There are times when a fellow feels as though he could explode unless he gives out to someone."

"If you've got to get something out of your system, why don't you come to me and unload—it's not helping matters any to gripe and aggravate a sore spot, you know."

"Oh, I wouldn't say that—Reynolds is not one to shoot off his mouth," Ed countered. "Here, Al, take a look at this order for plug gages."

"Never mind the plug gages, my friend; don't try to evade the issue," insisted Al. "You know darn well you slipped, for the moment, as the foreman of the shop."

"What do you mean, slipped?" came back Ed. "Can't a guy open his mouth any more without you picking on him?"

"I wouldn't stay that I was doing any picking, Ed," smiled Al. "You know I've always had your interest at heart—next to the firm's, of course, ahem!" continued Al. "I don't want you to do anything that'll affect your position."

"Just how do you figure that confiding in one of my workmen interferes with my working efficiency?" frowned Ed seriously. "You're the one who said to me just recently that I ought to be more human."

"I meant what I said, too, but this is a different story altogether. There's a difference in being human and in disclosing a weakness, Ed—don't you see my point?"

"The only point I can see is some sharp sarcasm. Now be honest, Al: What's wrong with airing my views about another man in the shop?"

"Well, if you insist in getting my opinion, Ed, it's this: You're letting one man know that you have a grievance and, in my opinion, I can't help but feel that the party of the first part—the man to whom you're beefing—lowers you slightly in his estimation."

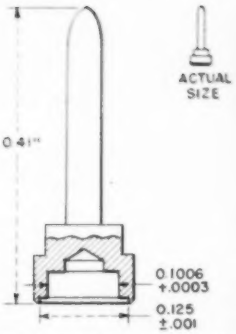
"Go on, Al; let's have some more—you're hot this morning."

"And furthermore, the chances are that Reynolds will make a slip one of these days, especially if he and Billings get their heads together—as all men will—and then there you have the start of combustion."

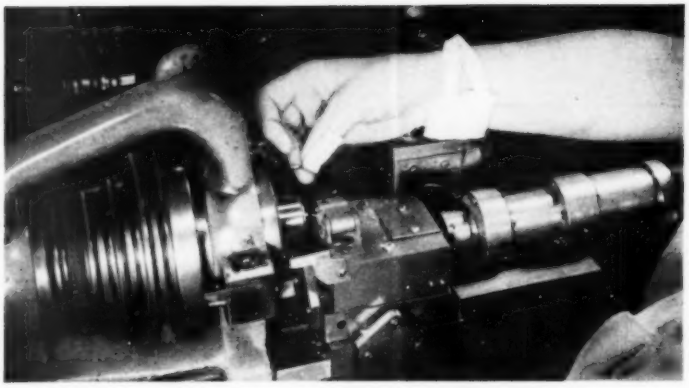
"You must have been reading up on Executive of yours?"
Control," cut in Ed. "Any more to this sermon

"Sure, Ed," laughed Al as he started to leave; "better catch up on your own reading."

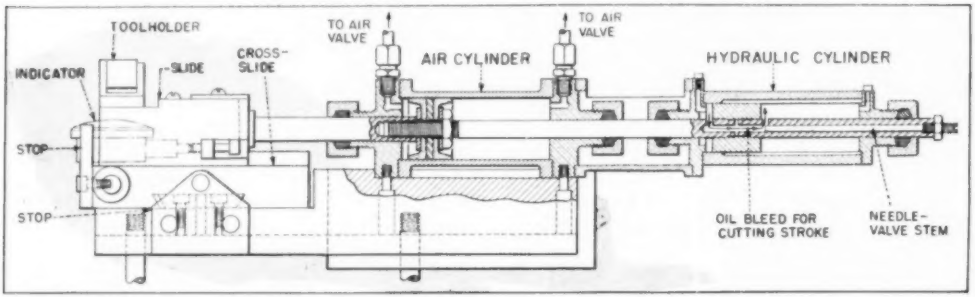
MUST A FOREMAN *keep his own counsel? Can he confide in a subordinate without potential trouble? If he can't, where will he blow off steam? Your ideas on this subject will help others. Discussions of earlier topics appear on later pages.*



1 **THE PART** is a jewel setting for a Type J meter—material: brass. Two counterbores in the large end are bored to a ±3 tenths tolerance by a two-step carbide bit



2 **THE SETUP** is on an Elgin bench lathe where the tool position is adjusted by setscrews. Operator starts semiautomatic cycle by pressing wrist pad on Micro Switch while reaching for a new part



3 **THE CYCLE** is controlled through an air cylinder in front of a hydraulic cylinder connected to the toolslide by a single piston rod. Movement of the slide under air power is metered by the hydraulic cylinder, which is relieved for most of its length. Fluid flows around the piston as the rod rapid-traverses the tool up to the work. When the oil piston is past the relief, a needle valve in the rod adjusts oil flow for slow traverse

Meter Miniatures From Model Tooling

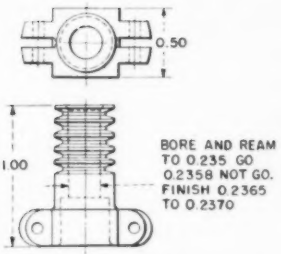
BY HARRY C. BALDWIN, Asst. Gen. Supt., Sangamo Electric Co.

SANGAMO tool engineers pulled out all the stops when they set up bench-lathe production for small meter parts. In addition to economical motion expenditures, such extra touches as unusual carbide tooling, tandem mounting of power and control cylinders, and air gaging have made precision production both speedy and more accurate.

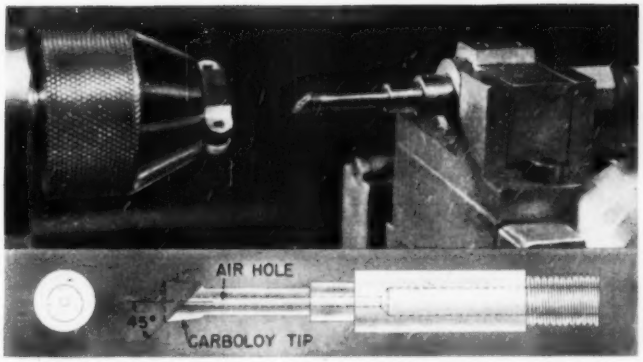
High production rates are essential if close-tolerance production is to be kept within reasonable cost limits. Sangamo tooling for many small meter parts uses devices such as pneumatic feeds on toolslides where close boring must be done.

Air-powered cycling is made automatic by Micro Switches, solenoid four-way valves, and rapid and slow traverses of the slides by means of hydraulic cylinders working on the same piston rods as the air cylinders and slides. Operators trip starting switches as they reach for new parts and manipulate collet chucking levers with their left hands. Small parts allow highest cutting speeds and carbide tools minimize wear.

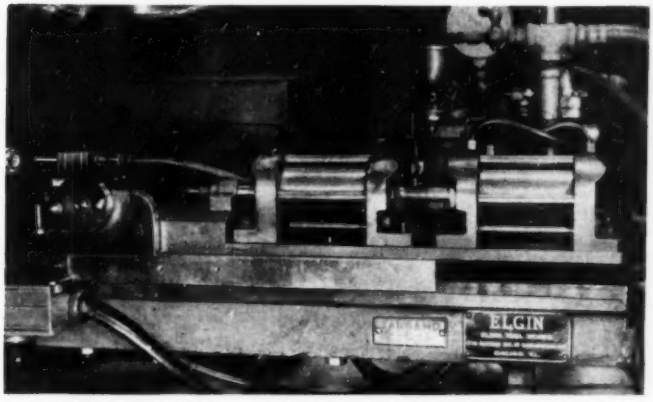
Many of the air and oil cylinders have been made in the Sangamo toolroom as part of the work orders for tooling. Such orders only require valves and switches to be purchased. Recently, tooling has been designed around standard commercial cylinders that are generally less compact but just as serviceable.



4 **THE PART** is a circular rack for a tachograph—material: bronze rod. A sliced-off carbide tip on the turned toolbit bores a straight hole and the steel shank burnishes

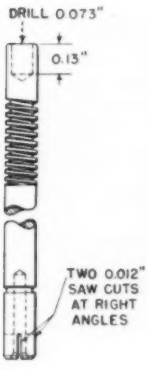


5 **THE SETUP** is on another Elgin lathe with the toolbit clamped in line with the spindle. An air blast through the hollow tool shank kicks chips out through the spindle so they will not damage the work or bind under the tool



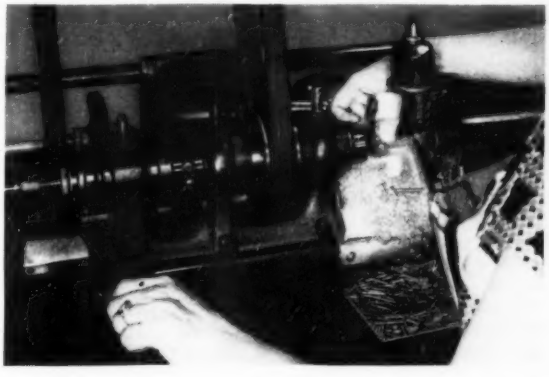
6 **THE CYCLE** here is semiautomatic, too. The hydraulic cylinder is ahead of the air cylinder and its metering valve is above the toolslide. Hydraulic flow controls the action of the air-power cylinder that traverses the toolslide. This installation, like others at Sangamo, includes a standard air-pressure regulator and an air-line lubricator ahead of a solenoid-operated four-way valve

7 **INSPECTION** of each circular rack is done at the lathe with a Sheffield Precisionaire gage. While the next cycle is starting, the operator checks the bore of the last part

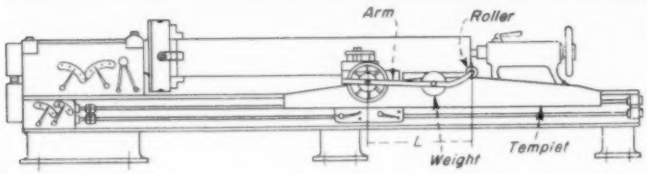


8 **THE PART** is an aluminum worm meter spindle that is drilled (No. 49) to a 0.130-in. depth at one end. Two 0.012-in. saw cuts are required at the opposite end of the spindle

9 **THE SETUP** on a Sangamo bench lathe employs automatic air and hydraulic feed for the drilling job. Electric motor directly behind lathe headstock runs saw that makes two cuts in spindle while operator locates already drilled part



Practical Ideas



Timber Templet Guides Feedscrew For Large Taper-Turning Job

SEVERAL 8-ft rollers with 2-ft diameters had to be machined for replacement in textile machinery. They had to be 0.031 in. larger at the middle diameter than at the ends, and the machined outlines had to be smooth curves.

The work was done on a large engine lathe that was 20 ft between centers and had a 36-in. swing. First, a selected timber was shaped to an arc with a rise (and fall) of 3 in. over the 8-ft length. This was attached to the rear of the lathe (shown in front for clearness) and was leveled with the bed. The toolbit was mounted on the rear of the slide and was inverted.

A long arm was fixed to the cross-slide screw and was fitted with a small roller that rode on top of the templet. A heavy weight was added to the arm to keep the roller down on the templet against the resistance of the screw. As the roller moved up and down during the cut, the arm turned the cross-slide screw to move the toolbit in and out, which altered the diameter cut. Backlash in the cross-slide was eliminated by a strong spring on its rear end.

To get the change in diameter on the rolls, the tool had to feed in and out 0.0155 in. The cross-slide screw was a double thread with 4 tpi, so the pitch was ½ in. This coarse pitch was normally a disadvantage, but in this case it simplified the feeding action quite a bit.

One revolution of the screw would feed the toolbit ½ in. The rise of the roller on the templet was only 3 in., so this was considered, for practical purposes, equal to an arc of a circle with a radius as long as the arm. To find the length of arm required for the job, a proportion was set up like this:

$$\frac{0.0155}{0.5} = \frac{3 \text{ in.}}{2 \pi \times L}$$, where L was

the length of arm required. L in this case was equal to about 16 in., so the arm was made and the timber was located lengthwise on the lathe so the toolbit was at the center of the roll when the roller was at the middle of the templet.

This was a small radial movement of the tool, and the pitch of the screw was coarse, so the method worked. With a fine-pitch screw and a larger movement, a system of gears might have to be used. In any case, the principle could be applied to any similar work, with the follower arm attached either to the front or rear of the cross-slide screw.

In the example described, an error of 1/64 in the templet would produce only an error of a thousandth on the work, so a carefully made templet would produce excellent work. *Michael P. Blake, Charleston, W. Va.*

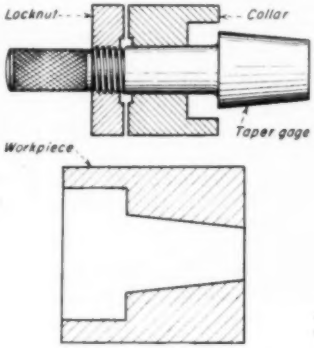
BLUE VITRIOL SOLUTION can be used in more ways than just as a layout device. Before pressing a bushing into a hole, paint the bushing's OD with the solution, and also paint the bore. After the parts are assembled they will be found to be stuck firmly together. *E. Diskavich, Torrington, Conn.*

Locknut and Collar Adapt Gage for Hidden Bore

INTERNAL TAPERS on some parts we recently made couldn't be gaged from the small end because we had to use a plug gage. But the tapered bores were 1 in. away from the face nearest the large end, on the other side of a counterbored section.

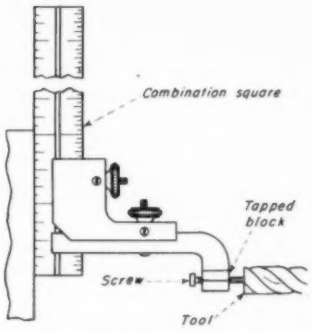
The depth of the taper made it difficult to check when the operator used Prussian Blue, so we made an attachment for the gage that was used by both production and inspection men.

The gage itself was made with a threaded section on its shank. This section was raised off the



knurled end of the shank and ran a half dozen turns toward the plug end of the gage. The shank beyond the thread was the same diameter as the crest of the thread. Both the collar and the locknut were counterbored on their matching faces.

A large counterbored collar fitted on the turned shank, and its OD was just under the ID of the counterbored section of the part. A second collar was tapped and threaded onto the shank as shown to act as a locknut. The locknut was adjusted to act as a *go* and *no go* indicator when the gage was pushed into the taper and the collar rested against the end of the part. *Charles Schwartz, Brooklyn, N. Y.*



Combination-Square Device Locates Tools on Automatics

WE USE this tool on Gridley automatic screw machines to set tools a specific distance from the face of the main toolslide. However, the gadget has become popular all over the shop for use anywhere tools or work must be located from a surface that is best measured from the edge of a scale—especially when the edge must be projected to be measured.

The tool is made from flat stock cut to shape and bent around a square block. The block is drilled and tapped for a long adjustment screw, and is tack welded or soldered into the flat stock. Rough tool settings are made with the tool held in a combination-square attachment and held against a locating surface. Fine adjustments are made with the screw, which can be graduated like a micrometer. *Donald E. Wood, Allegan, Mich.*

Blue Vitriol for Press Fits

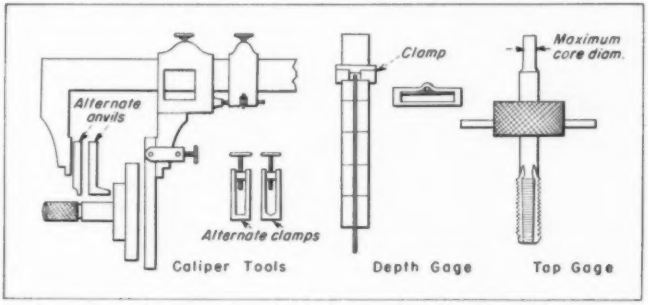
PRESS-FITTED PARTS, once they have been disassembled from each other, don't go back together with the same fit they once had. Instead of grinding down one part, plating it, and regrinding it to a new size so it can be pressed into place again, you can simply apply copper sulphate (blue vitriol) to the mating surfaces and reassemble them. The sulphate deposits a thin coating of material, which will compensate for the tear-down job. *Stanley R. Welling, Racine, Wis.*

Hollow Mill for Special Job Made from Acorn Die

SPECIAL-SIZE hollow mills are expensive, and so is the process for making the mills in the shop. When I needed a left-hand mill with a 0.247- 0.249-in. diameter, I took a high-speed Acorn die (#12032) and chucked it in a bench lathe.

A hand grinder was mounted on the cross-slide by strapping it to the slide, and a 3/16-in. silicon-carbide wheel was mounted on the grinder and the grinder was turned 2° from the lathe axis to provide a back-clearance angle of 4°. The mill was ground until a piece of ¼-in. drill rod could be slipped into it, and then the teeth were sharpened.

The mill has turned down over 300,000 pieces of cold-rolled steel and will probably cut as many more. This method of manufacture by-passed heat-treating problems we would have had if we had tried making our own tool from high-carbon stock. *Otto V. Howe, Waterbury, Conn.*



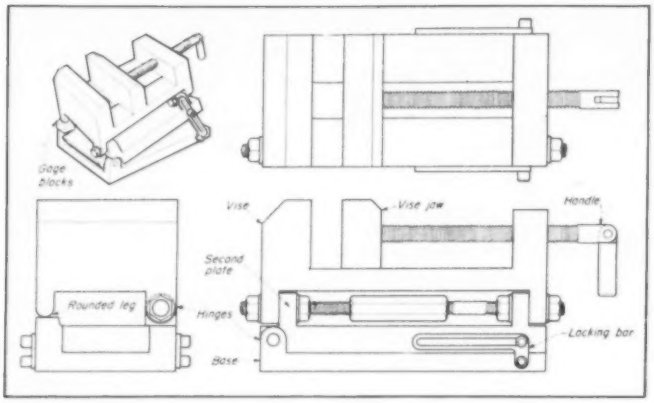
Three Inspection Tools Are Samples of Inexpensive Gages

THESE GAGES for odd-job inspection are good for ordinary non-precision limits, and may suggest numerous other similar types.

The vernier-caliper attachments are made to convenient nominal widths, like 0.10 in. for the thinner pieces and 0.30 in. for the larger back-up piece. A simple saddle clamp is attached to the backup piece so it can be attached to the caliper for measuring to a dished end of a part. The attachment insures that the caliper beam will be parallel to the axis of the part. Smaller pieces can be made for checking to shoulders, slots, recesses, and the like when one end of the part is not made to any particular dimension. A saddle clamp with a V-slot can be employed for holding a rod when measurements must be made to a hole.

The depth gage is for small holes that cannot be checked with a commercial pocket depth gage. Hardened 0.050-in. wire can be used for the spindle, which is attached to the brass clamp with solder. A thin nickel strip is placed under the brass clamp to act as a bearing surface and to provide some spring to the clamp. The scale is a common steel one with markings of 32nds and 64ths.

The tap gage saves wear and tear on precision screw plug gages when high accuracy is not essential. The length of the threaded section is made to nominal size—like 4 in.—so the depth of a tap can be checked by measuring the amount of threaded section protruding from the hole. The other end of the gage is turned down to act as a gage for the root diameter of the thread, and the rod is case-hardened. A knurled collar provides a gripping surface, and two pins give extra purchase on large gages. *R. H. Fry, Croydon, England.*



Machine-Table Vise Can Align Parts in Any Position

A COMPOUND-ANGLE vise can handle one-of-a-kind setups that would ordinarily call for special fixtures and a lot of hard work. This one was made for grinding work, but is also good for drilling and milling.

The construction amounts to adding two hinged plates under a machine vise with special feet. The left end of the lower plate, or base, is hinged to the second plate at the left end, and the vise is hinged to the second plate in the front. Two locking bars attached to the base and second plate fix the lower adjustment which should be gaged by a sine plate. The vise is raised off the second plate by gage blocks which fit under the two rounded-off legs in the rear.

An interesting feature of the device is that angles can be set almost automatically between the vise and the second plate. The distance from the center of the two hinges to the center of the rounded legs is exactly 3 in., so gage blocks reading three times the sine of the angle required are set under the legs.

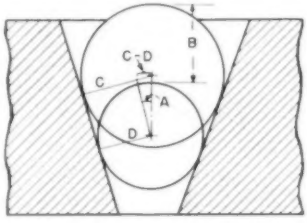
All surfaces of the vise and plates must be machined accurately so the planes are square to each other. This determines the accuracy of the vise. The side locking bars and setscrews may be removed when no angle is required between the base and the second plate, and the plate can be clamped down on the base by means of a socket-head setscrew.

The movable vise jaw is connected to the vise screw through a simple ball-and-socket joint. The simplest kind of handle was used on the vise screw to keep it from getting in the way when the vise was set up in a machine table. *Allan B. Nixon, Springfield, Mass.*

Depth Measurement with Balls Checks Conical Hole

WE HAD a tough grinding and inspection job not long ago. It was a conical hole through a hardened tool-steel plate that had to be ground as close to the correct cone angle as was possible.

It amounted to a cut-and-try job, and if the grinding wasn't bad enough, the measuring was almost impossible. However, after we set up the grinder with an adapter so the quill could be removed and replaced exactly, we worked out a method for measurement that is quite flexible and can be applied to many jobs.



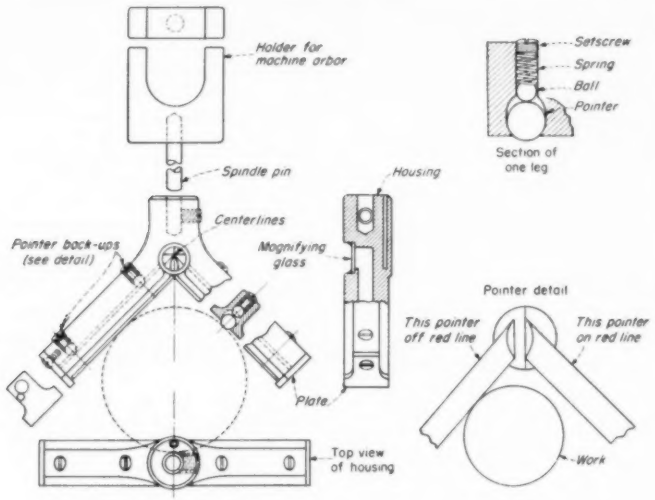
The tools consist of three balls (from bearings) with diameters ranging from slightly more than the small diameter of the hole to slightly under the large diameter. All three can be dropped, one at a time, in the hole and the distance from the top of a ball to the top surface of the plate measured with a depth gage. One ball may project from the hole, so a pair of parallels can be used on the plate to raise the gage anvil above the ball.

What must be measured for inspection purposes is the total included angle of the cone, or twice angle A in the sketch. This is found through dimension B, the difference in height between two balls of different radii, C and D. B can be found by measuring the depth to the lower ball directly, and by measuring down from parallels to the upper ball, then subtracting.

The triangle constructed between the centers of the two balls includes angle A. The distance between centers equals D + B — C. The short leg of the triangle equals C — D, so the sine of angle A equals $\frac{C - D}{D + B - C}$. The diameters of the balls can be measured once and each ball can be marked.

A set of three balls will cover most cases, and in addition, a double check of the angle, and a check to make sure the side of the hole runs straight, can be made by making two sets of measurements on the same hole with different combinations of the three balls.

Once the angle is known, the large diameter of the hole can be easily found by substituting the unknown radius R, half the upper diameter, for the C in the equation. For this, you work backwards and assume that the dimension B is the distance from the top of the lower ball to the top of the plate. *Ray Cafiero, Brooklyn, N.Y.*



Double-Pin Gage Centers Shafts

SHAFTS with any cross-section can be centered under mill or drill spindles with a V-type gage that attaches to the spindle. The gage consists of a cast housing the holds two indicator rods that work in two hollowed-out legs of the casting.

Two round slots are open at the ends of the legs and meet at the center of the housing, in the middle of the V. The pointers are held in the slots by means of plates screwed to the casting at the ends of the legs, and also by the partially overlapping edges of the slots on the under side of the gage. Setscrews and springs back up the rods along the legs to force the pointers down toward the work.

At the bottom of the V, a magnifying glass is set in the housing to show up the ends of the pointers and the inside of the cavity. This is painted glossy white, and a set of vertical and horizontal centerlines is painted over the white in red. The ends of both pointers are cut down to form knife edges.

Action of the device is thus: The work is brought under the device, which can be clamped in the arbor of a miller with collars. The shaft is moved up toward the center of the V until one or both of the pointers is touched by the shaft and is moved against spring pressure. Because both pointers move independently, the shaft is centered when the edges of the pointers come back together and just cover the red centerline.

The U-shaped holder can be removed from the gage and the device can be held in a vertical spindle by means of the pin that is held to the housing by a setscrew. *W. A. Maring, Miami Beach, Fla.*

Two Colors Help Layout

INCREASED VISIBILITY has resulted from a layout system we started some time ago. Raw casting and forgings are painted a yellow or light-colored paint before they come into the machine shop. Then the regular bluing solution is applied to surfaces which must be laid out. A part is scribed so the yellow paint shows through.

When the part is inspected before it is put into production, the layout lines show in a contrasting yellow against the blue color, which reduces fatigue and increases efficiency. *Stanley R. Welling, Racine, Wis.*

$25 *In addition to regular payment*

for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

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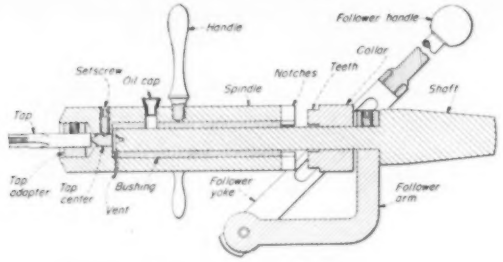
WHO MAY ENTER— Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

81st Winner:

Jack Harris
Tap-Size Mathematics



Quick-Clutching Attachment Speeds Lathe Tapping

SPEEDY TAPPING operations are handled by this attachment which cuts down on lateral movement of the tailstock spindle.

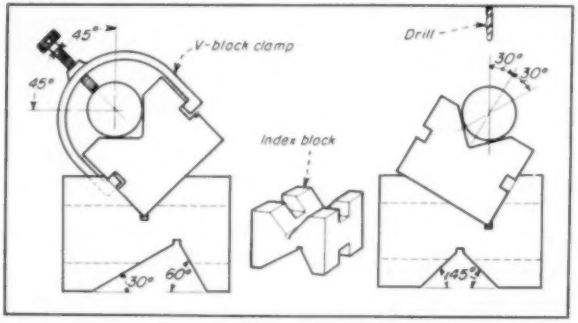
The main shaft was turned with a taper to fit the tailstock spindle, and this formed the base of the attachment. The outer end of the shaft was turned to a standard size and was polished. The spindle was turned from high-carbon steel, like the shaft, and was bored at one end for a bushing; at the other for a tap socket and center. The socket was machined square to hold a tap collar.

The bronze bushing was pressed into the spindle, and cleared the shaft with about three tohusandths leeway. Two notches were cut through the pindle and bushing at the tailstock end to mesh with two teeth cut in the spindle-locking collar. Three handles were threaded into tapped holes around the spindle, and an oil inlet allowed for lubricating the bushing.

A follower arm was clamped to the shaft behind the spindle, and this was pinned to a follower yoke that was pinned to the collar. With this arrangement, the operator held the spindle and tap firmly in position by moving the handle forward so the teeth engaged the slots in the spindle. When full depth in the hole was reached, the operator moved the handle back, which disengaged the teeth, and allowed the spindle to rotate with the work. The lathe was then stopped and the tap backed out of the hole by means of the three handles on the spindle.

Taps were held in square, nut-like adapters with setscrews recessed inside the blocks. Flats were ground on the taps for good holding. The device was used only with taps under a 1-in. size. The tailstock was, of course, locked when the tapper was being employed.

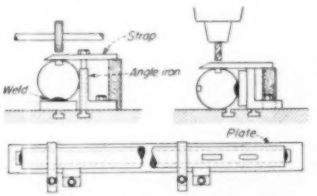
Two setscrews held the follower arm to the shaft. The other pins on the linkage were fairly loose, but the slots in the yoke were filed free from burrs to prevent any sticking. *Lowell F. Stull, Youngstown, Ohio.*



V-Block with Slanted Cut Indexes Work at Common Angles

BOTH V-CUTS in this block are cut at 90° with a clearance slot at the bottom, but one is slanted off at 60° to the bottom of the block. The other is at the conventional 45° to the top of the block.

This arrangement makes it possible to locate work on the common angles, which increases the value of the block. Slots through the top and bottom faces of the block clear the workholding clamp attached to the standard V-block that is used in conjunction with the special block. Application of the idea is not, of course, limited to the illustrated angles. A larger block could be made with four V-cuts—one on each of four sides—to increase the number of possible angles for setup. *S. Framurz, Bombay, India.*



Tack-Welding Method Aligns Shaft for Right-Angle Keyways

HERE'S A METHOD for cutting keyways in shafts at right angles to each other: Tack-weld the shaft to a flat plate slightly longer than the shaft and slightly narrower. The shaft is cut oversize in length to allow for the welding at both ends.

For one keyway, the shaft can be clamped down with the plate under it. Clamping the shaft with the plate square against the angle plate will align the shaft at 90° to the first setup. *A. A. Sinisi, New York, N. Y.*

NEWS OF METALWORKING

Drop in U.S. Exports Will Affect Tools and Machinery

WASHINGTON—Forecasts of a near-record year for U.S. exports are being modified by developments here and abroad. Foreign sales of American production over the next 12 months may drop $2 billion below earlier forecasts of almost $14 billion.

Two forces work to lower the forecasts: (1) Britain's decree last month slashing dollar buying by 25%—an estimated $400 million a year (see story, page 132); (2) ECA is almost sure to have its second-year appropriations cut $500-$600 million below Paul Hoffman's estimated minimum requirements, for ECA, having no direct vote-getting power, is an obvious target as Congress looks around at ways of cutting government expenses.

Capital equipment producers will be the hardest hit by the revised ECA program. Procurement authorizations for construction and mining equipment, industrial machinery of all types will fall off, but special machine tools won't be affected much.

Fiat Buying $15 Million in Tools From U. S. to Speed Production of Autos

NEW YORK—Some $2 million in dies, jigs, fixtures and stampings for the Fiat Automobile Co. at Turin, Italy —first part of a total $3½ million order placed by Fiat with the Budd Co., Philadelphia—were shipped from that city late last month.

The tools are to be used for production of a new model passenger automobile of unit construction (body and frame integral, as in the Nash). Largest item shipped was a 50-ton die for stamping automobile roofs from sheets of steel.

Buy from Several Builders

According to Mr. Luigi Sossi, Fiat's American representative here, the Budd order of $3½ million is only a part of a total machine-tool buying program started in October, 1948, amounting to $15 million, in which major sharers are Bianchard, Cincinnati Milling, Ex-Cell-O, Gisholt, Gleason, Heald, Jones & Lamson, National Acme, National Automatic Tool, Norton, and Sundstrand, among many other tool builders.

Inability of Fiat to obtain quick action from ECA caused the firm to bypass that organization temporarily, backing its orders with private loans, including a $10 million short term loan from the Bank of America, meanwhile hoping that the application for an ECA loan eventually will be approved.

ECA authorization for the $15 million tool buying program, and for $5 million for purchase of steel mill equipment to improve Fiat's steelmaking facilities in the Turin area, was asked more than a year ago.

Fiat's plans for machine-tool buying in the U.S. don't stop with the present $15 million allotment, Mr. Sossi said. The Italian firm plans to spend another $15 million next year, the purchases to be used to push production of new Fiat models and to bring up to date its present tools.

Most of Tools are Obsolete

The company now has some 8000 tools, many of which are obsolete, of some 20-years' vintage. These must be replaced if production costs are to come down.

Practically all tools are bought from U.S. builders, with some bartering between Switzerland, which is Fiat's best passenger car market, and negligible purchases from England despite Italian government urging, according to Mr. Sossi, that Fiat do more buying from U.K. to liquidate Italy's frozen sterling assets there.

Buying is done direct from Fiat headquarters in Turin. Mr. Sossi's function here, as American representative of Fiat, is to follow through on arrangements made between Fiat and equipment manufacturers here.

Producing 300 Cars a Day

Fiat is producing approximately 300 cars a day, of which 30-35% are for export. They have made no attempt to enter the American market, Mr. Sossi said, the bulk of the sales being to the Swiss, the northern European countries, and to India and to Argentina.

Fiat has concluded a deal for the manufacture of diesel trucks in Buenos Aires, in which Argentina will buy all machinery needed and set up the plant. Fiat serving as consultants only. The company also is working on plans for an automobile factory in Barcelona, Spain, and has a contract signed a year and a half ago to build a plant in Poland.

***RESEARCH MACHINE SHOP**—Between 3,000 and 4,000 jobs will be turned out yearly in Gulf Oil's new machine shop at the Hamarville, Pa. research laboratory. Jobs are mostly "one of an item" for geophysical prospecting equipment, other developments of the research staff, and the testing of the firm's cutting oils and grinding oils under normal and special machining conditions. To qualify as a journeyman in this 90-man shop, apprentices must take 10,000 hr. of training .*

Postwar Boom is Over for Swiss Metalworking; Fight Trade Controls

By BOYD FRANCE
(McGraw-Hill World News)

ZURICH—The Swiss metalworking industry has reached a critical crossroads. The postwar boom is definitely over. That leaves the industry fighting for its life in a world market increasingly cluttered with government trade controls and squeezed in the vise of bilateralism.

For the metalworking industry, like most Swiss industries, must export to live. It has to import all its raw materials except hydroelectric power and a little low grade iron. That means selling about three-fourths of its gross product abroad to pay for its imports.

This was easy until recently. The industry came through the war with its plant miraculously intact in the midst of Europe's ruins. It didn't even have to convert from war production. It was able to step into the hungry postwar sellers' market fast and take a nice profit on its desperately needed machines.

The cream of this postwar demand for Swiss machines had been skimmed off by June last year. The volume of incoming orders has been dwindling relentlessly since then and now is over 30% off its peak level. That still leaves the industry with an order backlog fat enough to keep it turning over at near capacity for about two years. It also set a new export record last year. But the fact remains that the postwar peak has been passed; this year's export figures are bound to reflect the falling off of orders.

Government Restrictions Hurt

The heart of the problem is not strictly economic. Swiss manufacturers blame the cancerous postwar growth of artificial governmental restrictions on free multilateral world trade for most of their export troubles. The industry isn't so worried about tariffs. Quantitative trade restrictions threaten the industry much more than tariffs. Currency controls and import quotas are the worst of these. Their effect is to rivet trade into an iron jacket of bilateral trade treaties.

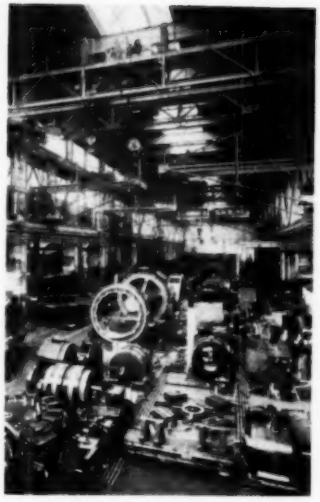
Threat to Metalworking Industry

Two facts give a quantitative measure of the threat to the Swiss economy and the metalworking industry of these trade restrictions: One, Swiss trade is now shackled by more than 70 bilateral trade treaties. Two, a total of 37 nations have slapped new restrictions on imports of a wide range of the products of the Swiss metalworking industry.

Swiss machine manufacturers hoped the Marshall Plan would push western Europe towards a more liberal trading pattern. But so far ERP has hurt their exports more than it has helped them. Switzerland stayed out of the Marshall Plan. So ERP has had the effect of channeling intra-European trade around Switzerland.

The temporary elimination of the German economy from the world marketplace also has complicated he trading position of the Swiss. Swiss industry was able to take advantage of the German knockout to expand into fields occupied prewar by Germany. Best examples are certain types of hydroelectric equipment and machine tools. But in general Swiss machine men have gone slowly in trying to take over prewar German markets; have resisted the temptation to over-expand to fill a temporary demand.

More important than the expansion of the Swiss metalworking industry into the production vacuum left by the postwar collapse of German industry was the temporary loss of Germany as the main supplier of raw materials.



***ASSEMBLY SHOP** of Brown-Boveri, biggest Swiss machine maker*

Before the war Germany supplied 30% of Switzerland's iron imports, 50% of its coal imports. During the war these percentages rose to 45% and 87% respectively. They dropped to practically zero in the immediate postwar period forcing Switzerland to turn to higher cost sources of supply, notably the U.S., for its coal, iron, and semi-finished steel. Now Germany is slowly coming back as a supplier of Swiss industry's raw materials. It won't regain its prewar position for some time, however. Reason: Bizone restrictions on Swiss exports to Germany have kept trade between the two countries heavily unbalanced in Germany's favor.

This is just another aspect of the overall problem of liberating world trade from the artificial controls which are paralyzing it. The survival of the Swiss metalworking industry in its present form depends in the long run upon working out a satisfactory solution to this problem.

Problem Will Be Solved

But this will take years at the best. Meanwhile, the Swiss metalworking industry is betting that the problem will be solved; is continuing to evolve along its traditional lines on that assumption. Here's a quick look at the industry today—its importance to the Swiss economy, what's being made, what's being sold, where.

The metalworking industry is Switzerland's most important single industry. It currently employs about

France is Biggest Buyer of Swiss Machines

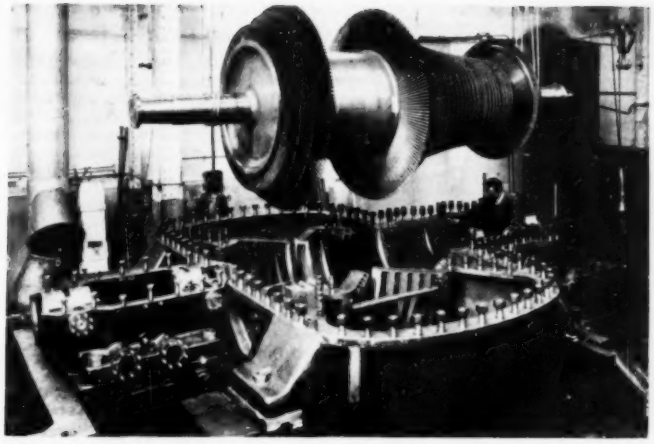
France consistently has been the biggest buyer of Swiss machines, spending 144.2 millions in Swiss francs in 1948, 112.4 in 1947, 198.2 in 1946, and 30.9 in 1938.

Other 1948 leaders in purchases of Swiss machines (in millions of Swiss francs) were: Belgium, 101.1; Netherlands, 83.3; Czechoslovakia, 53.7; Brazil, 42.9; Argentina, 42.8; England, 39.7; Italy, 34.7; Sweden, 34.4; Spain, 24.9; Ireland, 25.9; Portugal, 24.7; United States, 18.3.

U. S. 1938 purchases of Swiss machines amounted to 4.7 millions in Swiss francs; 13.0 in 1946, and 12.7 in 1947.

In '46 and '47 Belgium was second to France as a buyer of Swiss machines, spending 88.3 million Swiss francs in 1947 and 57.5 in 1946. But in 1938, Netherlands was second, spending 28.4 millions. That year England stood third with 25.5, but in 1946 and 1947 ranked tenth.

Total value of Swiss exports by year, in millions of Swiss francs: 292.5 in 1938; 568.5 in 1946; 778.4 in 1947; and 935.7 in 1948.



***A STEAM TURBINE** by Brown-Boveri is in the making here, an example of what Swiss industry is doing today. Photo shows the lower half of casing and rotor*

175,000 workers and 55,000 administrative and sales personnel. That represents 36.5% of the total industrial working force. And the industry also has 37% of the total power installed in industry—about 5.2 million horsepower.

The industry is split up into nearly 2,500 plants, most of them employing less than 100 people including administrative staff. Only two plants have more than 5,000 workers; two others between 3,000 and 4,000, and 18 between 1,000 and 2,500.

This extreme dispersion reflects the high specialization of the industry and the small scale on which it operates. The average charge in the production of rolled products, for example, is around 50 tons and half-ton charges aren't unusual. Production is correspondingly low in machine making and labor costs throughout the industry are proportionately high per unit produced. This is true even for foundry products such as the malleable fittings made by Fischer, Schaffhousen, where labor costs are 40% of gross production costs. It is more than 70% in the watch industry.

Variety of Products Turned Out

The high specialization of the industry is matched by the variety of products which it turns out. The big categories are textile machines, heat engines such as diesel engines, steam and gas turbines, machine tools, testing machines, watches, electric motors, power equipment of all kinds, water turbines, wood-working, agricultural, food processing and flour-mill machinery, and mechanical, electrical, and electronic measuring instruments. Railroad coaches and locomotives, and some tractors and trucks also must be added to the list.

Within these broad categories the list of products manufactured is even more varied. But in practically every case only those items are made which do not lend themselves to mass production.

The Swiss metalworking industry also tends towards integrated balanced plants in which a great many different things are manufactured by the same company at the same plant. In this connection it is worth noting that Switzerland has no important metallurgical works which are not attached to a machine factory of some kind or other.

Oerlikon, for example, makes everything from textile machines to its famous anti-aircraft gun ranging through high speed lathes, drills, generators, grinding machines, gear cutters, and munitions. Brown Boveri, biggest Swiss machine maker, also makes a bewildering variety of items such as steam turbines, gas turbines, turbo-generators, switchgear, transformers, circuit breakers, mutators, electric drives and control gear, electric kilns and furnaces, electric welding equipment, compressors and blowers, marine equipment, high frequency communications equipment. One of the company's most important "firsts" is its well known "Velox" oil-fired boiler. Brown Boveri also carries on extensive research with super-sonic wind tunnels.

Escher Wyss is perhaps best known for its closed cycle gas turbine but it also makes a large range of other machines. Examples: water turbines, valves and safety devices, pipelines, steam turbines, steam boilers, turbo-pumps, variable pitch marine propellers, turbo-compressors, axial blowers, variable pitch airscrews, refrigerating machines, air conditioning equipment, heat pumps, evaporating equipment, industrial centrifuges, food processing machines.

Keeps Eggs in Many Baskets

These three examples of the flexibility and versatility of the Swiss machine industry illustrate a pattern which generally holds good for the whole industry. This is not a chance pattern. It is the product of the master strategy of the Swiss economy—to keep its eggs in as many baskets as possible. The country's complete dependence upon the vagaries of foreign trade makes it particularly vulnerable to the slightest change in the international economic weather.

Switzerland's only defense is to be prepared for anything; keep its industry sufficiently versatile so that it can shift fast with shifting world demand.

This basic pattern is faithfully reflected in the table below showing the value, and composition of exports of the Swiss metalworking industry over the past three years.

Composition and Value of Exports of Swiss Metalworking Industry

(Millions of Swiss Francs)

	1938	1946	1947	1948
Boilers and other tanks	6.5	15.1	22.9	27.2
Refrigerators and other refrigerating equipment	2.3	4.1	7.4	9.8
Textiles machines	34.7	92.8	125.2	169.1
Bookprinting and bookbinding machinery	2.9	7.8	13.7	19.3
Flourmilling machines	4.1	6.1	11.8	17.5
Hydraulic machines	9.3	16.0	14.3	20.2
Steam engines and turbines	11.4	19.3	21.5	26.9
Internal combustion engines	24.5	54.3	69.5	57.5
Machine tools	42.2	82.5	116.2	120.3
Machines for the food industry	18.2	16.8	24.2	28.1
Motor vehicles and parts	14.4	10.8	13.2	14.1
Electrical equipment for motor-vehicles	5.5	7.4	14.5	14.8
Astronomical, geodetical, and scientific instruments	4.5	9.2	9.7	13.4
Typewriters and calculating machines	5.7	16.8	21.9	22.2
Gramophones and cinematographical equipment	3.5	10.5	13.4	11.8
High and low tension equipment	60.8	90.6	117.3	160.3
Locomotives (including electric)	*	—	—	4.1
Agricultural machinery	—	—	—	5.4
Machines for the paper industry	—	—	—	6.6
Construction machinery	—	—	—	5.4
Other	47.0	108.4	161.7	181.7
TOTAL	292.5	568.5	778.4	935.7

(*Official figures not available)

Cuts in U. K. Tool Buying Here Won't Hurt Special Machinery

LONDON (McGraw - Hill World News)—British purchases of American and Canadian machine tools, production equipment and semi-finished raw material metals will be cut back, but not permanently curtailed, as a consequence of the "standstill" on imports from dollar areas recently imposed by the Treasury.

The "standstill," ordered by Sir Stafford Cripps on June 25 and announced to the House of Commons early in July, called on all British Government departments to hold off on new orders until a revised import program could be prepared. This may take some time, and the new program may not be ready before late August or early September.

"The standstill on new commitments," he said, "applies to all purchases of imports, both on government and on private account. We are, of course, continuing to honor all existing contracts and commitments, and all import licenses which have already been issued. The standstill applies to new purchases.

"We are making exceptions in particular cases (such as) where failure to make small purchases would have altogether disproportionate effects upon our production and our dollar earnings.

"Spare parts urgently required for machines already in this country clearly satisfy (this) condition.

"Production parts for assembly here would normally come within the field of existing commitments.

Standstill on Machinery

"On machinery and miscellaneous manufactures the standstill will operate as I explained earlier. Any interference with imports of machinery is obviously undesirable, as we want the best possible re-equipment for our industry; that means in special cases importing some machinery. But the raw materials to run existing industrial capacity must come first, so that as things now are we cannot afford the considerable quantities of dollar machinery that we have been importing. But of course when we come to re-program, we shall include a new import program for machinery, though necessarily on a reduced scale."

Mr. Anthony Eden, replying (on the second day of the debate) on behalf of the Conservative Opposition, pointed out that "practically the whole weight of the cuts will fall upon imports of raw materials for industry and of American machinery." There were, he said, no alternative sources for the materials and machinery now being bought from the dollar area. He doubted that the Chancellor would be able to carry through his cuts without serious dislocation to British industry.

The original British import program for 1949-50, submitted to the O.E.E.C. on Oct. 1, 1948, called for imports of machinery and equipment totaling $162 million of which $122 million were to come from the dollar area; and for raw materials totaling $3,151 million, of which $637 million were to come from the dollar area.

Out of £43 million worth of imported machinery (in 1948), £31 million came from the U.S. £3.3 million of this was made up of machine tools, out of a total of £4.8 million.

Expect O.K. of Special U.S. Tools

Representatives of British firms importing American machine tools felt fairly confident that they could expect good treatment in the matter. Since so much of present British imports of machine tools are of the high - production special - purpose American machines, sorely needed to increase the output of Britain's motorcar manufacturers, aircraft builders, and other "key industries," and are of types not available in England or elsewhere, they expected that these would continue to be approved for importing about as freely as before. Up to the date of writing, they had had no direct evidence of any holding up of new applications, although one firm commented that scrutiny of new applications was getting progressively stricter.

All-Welded Construction for New Lincoln Electric Plant

CLEVELAND—The 20th anniversary of welding in American construction industries was signalized July 27 by ground-breaking for the new $8,500,000 all-welded, single-story plant to which the Lincoln Electric Co. will transfer all of its manufacturing of welders and electrodes in 1950.

Structural steel for the new plant will be fabricated at the Austin Company's Bliss Mill, located 3000 feet from the site of the new plant. Austin officials estimate that the use of welding, which eliminates the need for gusset plates and other structural items, has resulted in savings of over 10,000 tons of steel in the past 20 years at the Bliss Mill alone.

George A. Bryant, Austin president, stated that the new Lincoln plant will be constructed almost entirely from standard jig-fabricated H-section trusses, as a cumulative result of Austin's research in welded design and the application of mass production techniques to steel fabrication.

Monarch Man Goes Abroad to Supervise Lathe Installations

SIDNEY, OHIO—With 56 of its lathes, many of them carrying considerable special tooling, currently being shipped to European countries, The Monarch Machine Tool Co. here has dispatched abroad Willis Kuhlman, of its demonstration and service staff, to supervise the installation of the machines as they are received.

Before he returns several months hence, Kuhlman will have spent some time in at least 10 countries.

U. K. Imports of Various Machine Tools from U. S.

(First Five Months 1949)

	Drilling		Boring and Broaching		Grinding, Lapping and Honing		Lathes: Automatic		Lathes: Capstan		Lathes: Other	
Month	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
Jan.	3	£362	—	—	14	£ 41,334	7	£ 28,532	—	—	4	£18,687
Febr.	—	—	1	£11,698	14	40,726	2	9,490	—	—	3	3,176
March	—	—	—	—	15	45 422	35	74,689	—	—	7	2,864
April	—	—	—	—	9	10,658	—	—	1	£5,345	7	2,864
May	1	503	—	—	2	3,396	6	16,879	—	—	8	11,118
Total:	4	£865	1	£11,698	54	£141,536	50	£129,590	1	£5,345	35	£47,270

	Milling and Gearcutting		Planing, Shaping and Slotting		Sawing		Presses		Other		Used		Parts	
Month	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
Jan.	19	£ 70,128	—	—	2	£273	8	£32,483	9	£ 44,979	—	—		£ 65,808
Febr.	9	35,711	—	—	1	147	14	27,042	58	77,163	96	£37,654		69,845
March	24	36,532	—	—	2	274	—	—	15	55,457	1	323		51,334
April	8	29,303	—	—	—	—	22	410	14	33,864	50	13,492		54,701
May	8	29.247	6	£22,346	1	152	4	768	20	56,147	—	—		62,403
Total:	67	£200,921	6	£22,346	6	£846	48	£60,703	116	£267,610	147	£51,469		£304,091

Total Value (First Five Months 1949) **£1,244,290**

Source: British Ministry of Supply.

Congress Studies Depreciation Bills

WASHINGTON—Dozens of members of Congress have worked up schemes aimed at accelerating depreciation of plant equipment as a spur to new capital investment.

There's a provision for an amortization incentive to business in Sen. Murray's "Economic Expansion Act of 1949"—the successor to the Spence bill. This would allow taxpayers to elect (upon receipt of a certificate of approval from a presidentially-appointed committee) deductions for amortization over any period of not less than 70 months. Where assets have a life of less than 60 months the taxpayer may elect to take a period of one half of the depreciation period now allowable under the revenue code for such assets.

Other Bills Introduced

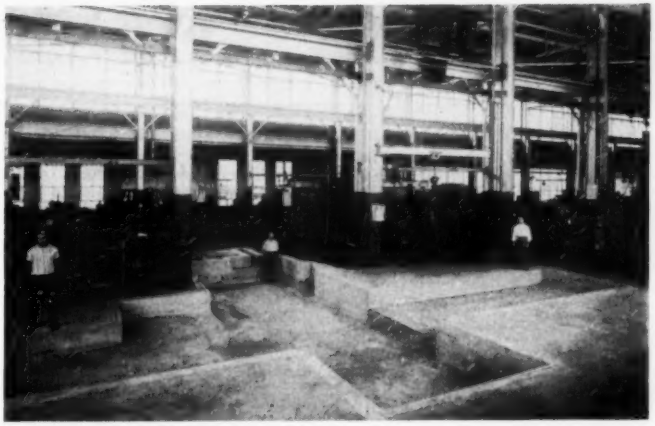
Here are some other bills aimed at accelerating amortization: H.R. 3897—introduced by Rep. Lane, (Dem., Mass.)—would permit taxpayers to amortize over 60 months. "Such amortization deductions shall be in amount, with respect to each month of such period within the taxable year, equal to the adjustment basis of the replacement machinery at the end of such month divided by the number of months (including the month for which the deduction is computed) remaining in the period. Such adjusted basis at the end of the month shall be computed without regard to the amortization deduction of such month."

H.R. 4543—introduced by Rep. Church (Rep., Ill.)—would grant a special amortization allowance of ten years or more for "productive facilities in any basic industry essential to national security which the president . . . officially declares to have capacity less than needed for security reasons."

H.R. 5696—introduced by Rep. Patman (D., Tex.) also provides for the election of an amortization period of as little as 60 months (or one-half the present rate of depreciation where normal life is shorter). Certificates of approval would be needed.

S. 175—introduced by Sen. Capehart—and S. 1410—introduced by Sen. Toby—are both identical with H.R. 3897.

Sen. George would like to see Congress set-up an agency for determining the maximum life of various kinds of machines, then you could figure out the depreciation basis that is fairest to all concerned. He thinks you would come up with ten-year depreciation generally—with stepped-up depreciation on individual machines with shortest life spans.



***READY AND WAITING**—This tremendous foundation at Hydraulic Press Mfg. Co., Mount Gilead, Ohio, awaits completion of a new Gray 8-in. planer-type horizontal boring, drilling and milling machine, weighing 175 tons. It will machine huge parts for hydraulic presses. It was previewed by more than 200 visitors at the G. A. Gray plant, Cincinnati, July 21-22. With a 75-hp spindle motor, the new unit will have head travel on column of 12 ft, continuous bar feed of 7 ft, column cross-travel of 10 ft, and a 9x20-ft table*

Pricing Bill Will Probably Pass

WASHINGTON—Delivered pricing legislation has been passed by both the House and the Senate. But as *AM* went to press, a legislative snarl in the Senate held up routine referral of the bill to a House-Senate conference committee to iron differences between the two bills.

Basically, they are much alike. Both legalize the use of delivered pricing and freight absorption when used by an individual seller in the absence of any conspiracy or combination. Also, both leave intact Supreme Court interpretations of the anti-trust laws as spelled out in the Cement Institute and Rigid Steel Conduit cases.

The debate on the floor of both houses, as they passed Sen. O'Mahoney's bill, was over amendments designed to make sure that the bill would not alter the Robinson-Patman anti-price discrimination law.

In view of the close similarity of both bills, one is sure to pass.

Cincinnati Milling Announces New Grinding Wheel

CINCINNATI—A new grinding wheel, result of a long period of research, is announced in the current issue of the technical magazine, "Report from Cincinnati Milling." The new wheels are produced in limited quantities only, thus are not available for the market.

While many previous technical reports from the Cincinnati Milling Machine Co. have dealt with fundamentals of metal-cutting action, this issue of "Report" tells how this basic research, applied to various types of single-point tools and milling cutters, can be applied to improve cutting action of the abrasive grains in grinding wheels.

"Report" reveals that the company's research engineers' efforts to improve the performance of abrasive grains as cutting tools in grinding have included an exhaustive study of the individual grains and their characteristics, together with the many variable factors which affect the wheels themselves. The engineers have been able to ascertain what the desirable characteristics are and have studied such factors, for example, as pressure, friction and heat, which are cumulative in their effect. Further, it is stated that performance records established under everyday operating conditions on all types of grinding jobs indicate the wheels have characteristics for improved performance.

Detroit

1949 PRODUCTION MAY SHATTER 1929 RECORD . . . KAISER PLANS STRING OF ASSEMBLY PLANTS . . . NEW DIE CAST ALUMINUM DOOR

AUTOMOBILE PRODUCTION is boiling up toward the highest level in history, its progress continued by the combination of sustained demand, plenty of raw maerials, and at least momentarily an absence of crippling strikes.

Toward the end of July all U.S. and Canadian plants were building at levels of approximately 150,000 units a week. Only in a few periods of distant 1929 was this rate of manufacturing in effect. The month's final figures will not tally up to the all-time record for any month—663,811 in April, 1929—but they will be around 600,000.

And August gives bright promise of even larger volume, with one mammoth "IF"—If the Ford Motor Co. is not strikebound by the CIO United Auto Workers union. During August there are 23 working days, and some makers are reportedly considering 6-day weeks to bite off all the market they can locate.

The heated output pace of the last few months, and the prospects for August, alone compel revision of all 1949 estimates which fell in the conservative class. Since the first of January, up to early August, total assemblies in all U.S. and Canadian plants are close to a mark of 4,000,000. With four and a half months of output left, the chances seem almost positive for a new full year record surpassing the 5,621,715 assemblies of 1929. Even a near-complete collapse between now and the end of the year would put that 20-year mark in danger.

Suppliers of equipment are looking with relish on releases expected shortly for the plant of a new GM subsidiary, General Motors Diesel, Ltd., on which construction is starting at once at London, Ont., Diesel-electric locomotives of all classes will be built, at a capacity rate of one a day. Employment will total around 1,000 persons at capacity in the 226,000-ft. plant.

Plans of Kaiser-Frazer Corp. for a string of small assembly plants around the country are also a matter of interest to suppliers, though there seems to be considerable doubt as to the economic feasibility of the project. Two plants are currently going forward, one at Portland, Ore., the second slated for sometime later in the Los Angeles area. Each, like the 50-odd others planned, will have capacity of about 20 cars a day.

Domestic branch assembly plants have rarely been operated in recent years at rates less than 100 cars and trucks or so per day, although some export assembly operations run down around 20 assemblies daily, even less. The economic factors involved in export operations, however, are not so strenuous as on the domestic front.

$500,000 in Conveyor Equipment

At any rate, K-F expects to put an average of $500,000 into each of the domestic plants it contemplates, mainly for conveyor equipment. The company hope: that efficiency and quality in small groups of workers, such as would staff such operations, would exceed the levels in big plants. Substantial savings from shipping costs are also anticipated.

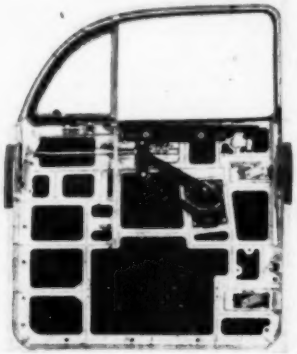
Kaiser-Frazer incidentally has come up with something else new. Always interested in aluminum (due to Henry Kaiser's Permanente experiences), the Willow Run manufacturer has been working with Doehler-Jarvis engineers on methods to die cast large 1-piece car body parts from aluminum. The largest casting produced thus far is a 13⅜-lb. inner door frame, 43⅜ by 33 in. Its use would eliminate four steel stampings per door, at least one welding jig, and a press line to form, trim and flange steel stampings

More Exact Door Sizes

K-F reports that the diecasting method not only produces more exact door sizes of all sizes, but also avoids springback problems. Completed doors with cast aluminum frames and steel outer coverings have been tested by K-F in laboratories and on the road.

The company is currently studying possibilities of aluminum die castings for other parts with relatively high fabricating costs—inner frames for instrument panels, rear deck lids, others.

Present prices of aluminum and steel make initial cost of all-steel doors about the same as aluminum-and-steel doors. The new type, therefore, probably will not appear on present models. But, says K-F, "the feasibility of molding body sections with worthwhile saving in time, labor, and weight" has been proved; the forward implications are evident if this holds water.



***DIE CAST ALUMINUM AUTOMOBILE DOOR** is being produced in the Toledo plant of Doehler-Jarvis Corp., New York, for Kaiser-Frazer Corp., Willow Run, Mich. Photo to the left shows the 13-ton die used in producing the auto door frames. The view of the door (right) is taken from the outside with the sheet steel panel removed. It is claimed that the door reduces by approximately 35 lb the weight of a four-door car.*

Names in the News

Walter E. Beaney

Walter E. Beaney has been named vice president and factory manager of The Whiton Machine Co., New London, Conn., and **Stanley E. Peterson** has been named vice president and secretary.

A. H. Brandel has been named production manager, Oldsmobile Div., General Motors Corp., Lansing, Mich., succeeding **P. J. Monagahan,** who will take over a new assignment in the sales dept. **Floyd V. Burr,** standards supervisor, has been named assistant production manager, succeeding Mr. Brandel. **J. J. Edwards,** general methods engineer, has been advanced to general supervisor of standards and methods.

Elmer W. Krueger has been appointed operations manager, The Cleveland Pneumatic Tool Co. Succeeding Mr. Krueger as manager of sales administration is **John M. Chapman.** Mr. Krueger joined Pneumatic in 1922, and after several years as designer in the engineering dept., was appointed assistant chief engineer of the Automotive and Aircraft Div. Later he was manager of the contract and scheduling unit.

Richard T. Wright has been named general manager of the Modern Tool, Die & Machine Co., Columbus, Ohio. He started with the company as an apprentice toolmaker 21 years ago.

Robert C. Overstreet has been named secretary of Tinnerman Products, Inc., Cleveland. Other appointments: **W. H. Taylor,** assistant to the vice president; **L. H. Flora,** chief engineer, and **R. A. Hartman,** manager of field engineering. In addition, Mr. Flora and Mr. Hartman were appointed to the company's executive committee.

Edwin D. Scott, who has had long association with automotive body engineering in the Detroit area, has joined Peninsular Metal Products Corp. as chief engineer. He has served on body activity standards committees as a member of the Society of Automotive Engineers.

Thomas H. Keating has been appointed general manager of the Chevrolet Motor Div., General Motors Corp., Detroit. General sales manager since October, 1945, and a member of the Chevrolet organization since 1916, he succeeds **W. F. Armstrong,** who has been granted a leave of absence because of illness.

Oren G. Rutemiller has been named chief engineer, Morton Mfg. Co., Muskegon Heights, Mich. He has been associated with Westinghouse Electric Corp., the Crosley Div. of Avco Corp., and during the past several years has been consulting engineer for several machine tool and special machinery manufacturers in the Cincinnati area. **H. A. Osborne** has been named manager of the Welding Fixture Div. of Morton.

Fred H. Pillsbury has been appointed vice president in charge of operations, Century Electric Co., St. Louis. He has been serving as executive engineer.

William W. Moore, a sales representative in Allis-Chalmers Detroit district office, has been named manager of the Milwaukee company's newly converted Toledo district office.

Edward R. Anderson has been appointed vice president of the Kellogg Div., American Brake Shoe Co., New York. He has been in the engineering and sales departments of the Brake Shoe & Casting Div. since joining the company in 1930. He became district sales manager of the Pacific district for the division in 1947. He will continue to serve in this capacity in addition to his new duties.

George F. Ritenbaugh, who rose from office boy to secretary-treasurer of Heppenstall Co., Pittsburgh, is retiring due to ill health after 40 years with the firm.

W. R. Patterson has been named general superintendent of the steel dept. at the Torrance, Calif., plant of The National Supply Co. He will continue in his present capacity as chief plant metallurgist.

Robert P. Melius

Robert P. Melius and **William A. Marsteller** have been elected vice presidents of Rockwell Mfg. Co., Pittsburgh. Mr. Melius was recently placed in charge of sales for the newly-created Power Tool Div. He has been with the Delta Mfg. Div. for 19 years. Mr. Marsteller for the past several years has been manager of advertising and market research for the company, as well as vice president of Edward Valves, Inc., East Chicago, Ind.

Henry V. Bootes, formerly assistant vice president, has been elected vice president in the sales dept. of the American Car & Foundry Co., New York.

J. Tedford Bachman has resigned as assistant vice president of operations, Sharon Steel Corp., to become general manager of sales of The Cold Metal Products Co., Youngstown, Ohio.

Robert J. McKenna

Robert J. McKenna, formerly vice president of Storms Drop Forging Co., Springfield, Mass., is now associated with The Billings & Spencer Co., Hartford, Conn., as their New England representative. He was with Storms for 23 years and prior to that time six years with Moore Drop Forging Co. His headquarters will be at the company's main office in Hartford.

Distributors to Hear Taft

CINCINNATI—Sen. Robert A. Taft of Ohio will be the speaker at the 25th anniversary banquet of the American Machine Tool Distributors' Assn. to be held here Oct. 31, in the Roof Garden of the Hotel Gibson.

A. G. Bryant, president of Bryant Machinery & Engineering Co. who is a past president of the association, will be toastmaster at the banquet.

Three speakers will address the Nov. 1 morning session of the meeting: Fred C. Dennis, partner of Lybrand, Ross Bros. and Montgomery, who will talk on "How to Read Your Customers' Financial Statements"; William K. Beard, vice president of McGraw Hill Publishing Co., who will talk on "Advertising"; and William A. A. Castellini, vice president of Dinerman & Co., public relations counsel, who will speak on "Public Relations."

Sub-Contract Information

WASHINGTON — Small businessmen seeking sub-contracts for large military orders now can get some help in their search from the 42 field offices of the Dept. of Commerce. Each field office has available for inspection a copy of the "U.S. Government Advertiser," a private publication, which lists weekly the Army awards over $100,000, in addition to a list of Air Force contracts.

Japan's Machine Tool Industry Faced With Huge Stock of Old Equipment

TOKYO (McGraw-Hill World News) —Japan's machine tool industry is running into hard times. Recently, the Japan Machine Tool Makers Assn. closed its offices. Members were unwilling to support statistical research and analysis. In the words of one association official, many members were more anxious to "spend money on parties."

Most serious blow to the machine tool industry was the U.S. unilateral decision to halt reparations. Two years ago the machine tool builders listed the threat of reparations as a major deterrent to recovery. Their view now has changed. End of reparations leaves Japan with a huge inventory of second-hand tools.

Original estimates placed Japan's total post-war inventory at 550,000 machine tools, plus or minus five percent. Approximately 300,000 were thought to be surplus to Japan's peacetime needs and, thus, available for removal as reparations. Under the interim removals program of the Supreme Commander for the Allied Powers (SCAP), approximately 40,000 machine tools have been shipped to China, the Philippines, Burma, Malaya and the Netherland East Indies.

With the increasingly tight financial situation in Japan, purchasers aren't interested in buying expensive new machine tools, when they can dip into this pool of 250,000 machines that remain in Japan. Obviously a considerable portion will be scrapped, but even 100,000 units are equivalent to three years of production by Japan's machine tool industry.

Total production for the fiscal year 1948, ending March 31, 1949, amounted to 7,299 machine tools. However, a large proportion were small bench type tools. The average weight was only 1,485 lb per unit and the value but Yen 86,227, approximately $400.

Production by types was: Lathes, 894 units, with an average weight of 6.000 lb; drilling machines, 3,501 units, 595 lb; boring machines, 1,187 units, 598 lb; milling machines, 67 units, 4,750 lb; grinders, 964 units, 840 lb; gear cutters, 84 units, 3,250 lb; planers, 6 units, 26,000 lb; shapers, 93 units, 7,200 lb; slotters, 5 units, 9,400 lb; others, 498 units.

Stampers Elect New Officers

CLEVELAND—Woodard G. Jeschke, president of the Res Manufacturing Company, Milwaukee, Wis., was named president of the Pressed Metal Institute, the national association of the metal stamping industry, at its first annual convention here on July 20-22. Other officers selected were Howard Wolf, vice president, and Joseph J. Boehm, secretary-treasurer. Wolf is assistant to the president of Mullins Manufacturing Company, Salem, O., and Boehm heads the Boehm Pressed Steel Company, Cleveland.

Outstanding achievement of the convention was the full committee organization, which makes possible for the first time in the association's six-year history an activated program of statistics and general information for dissemination to members. A completely-renovated constitution was also approved by the membership of PMI, which now stands at just under 200—an appreciable proportion of the stamping industry.

Talk among the members centered around the strides the industry has made in the past five years by mass production and replacing the heavier metal fabrication methods that involve high wastage.

Confidence was the prevailing sentiment among members. This feeling is predicated on the fact that one third of the business of the industry is in the field of automobile production.

61 NEW PRESSES, ranging in capacity from 75 to 750 tons, have been installed in the new stamping division of Studebaker Corp., South Bend, Ind., at a cost of $3,000,000. The equipment in the plant is capable of producing stampings for 1500 cars per day. At the left are two 500-ton presses while to the right is a 750-ton unit. Dwarfed between them is one in the 75-ton category

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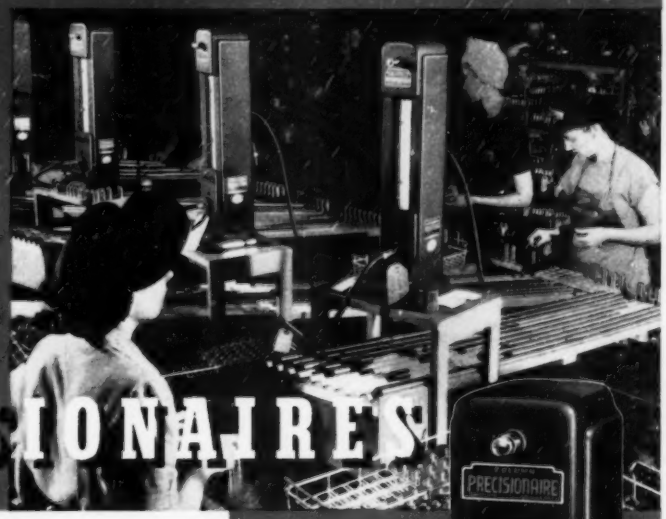

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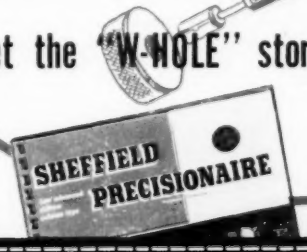

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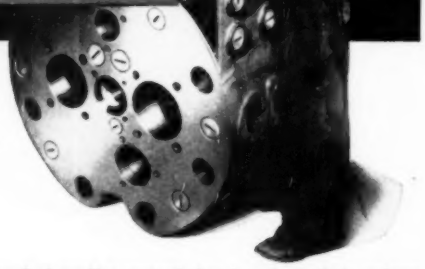

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Here at Hunt-Spiller you find quality control that is unique. It is unique because every phase in the production of machined cast parts is performed in our own plant. We produce and alloy the material, Gun Iron, in air furnaces — cast it in our own foundry — even machine the castings in our own manufacturing plant. This is important because it assures you of parts that have accurate physical properties for dependable performance as well as dimensional accuracy.

Typical of the parts that we produce complete are cylinder heads for marine diesel engines (illustrated above). Hunt-Spiller was chosen to produce these complete for three reasons. Gun Iron has proven the most durable material for these parts under high pressures for long periods of operation. At Hunt-Spiller there are craftsmen who can make the most complicated cored casting without defects, and Hunt-Spiller consistently machines castings to specified tolerances.

If you use cast parts that are subjected to frictional wear, pressure, high heat, it will pay you to investigate Gun Iron. For 139 years it has excelled for thousands of such parts in the railroad, diesel, marine, petroleum and metalworking industries. Our engineers stand ready to discuss its physical properties with you in the light of your specific problems.

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Contour Grinding with Crush-Dressed Wheels...I

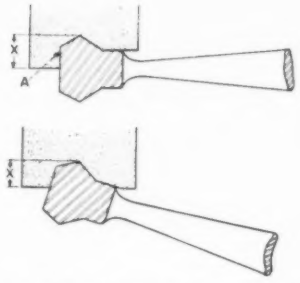
BY J. C. WILSON, Chief Engineer, and FREDERICK G. KRAFFT
Laboratory Head, THE THOMPSON GRINDER COMPANY

Primary Purpose — Contour grinding combines many operations into one and permits contours that would otherwise be difficult to produce. On contours consisting of tangent radii or blending curves, "Truform" grinding is also particularly useful.

The process is economical in production of parts such as the fir-tree sections of turbine blades, thread forms in rolling dies and chasers, serrations in milling cutter blades and knurling dies, punch and die sections for lamination dies and in production of the fine serrations in steel-wool cutting tools. Where two or more identical parts are required or where a blend of several surfaces in one part is required, the toolmaker will find the method suitable.

Crushing Rolls—These are generally 3 to 4 in. in dia in ⅛ in. wider than the grinding wheel. Bore and OD of roll must be concentric and sides of roll must be rigidly mounted so that exact duplication is accomplished. Accelerated wear tests have shown that 18-4-1 high-speed steel hardened to Rockwell C 62-64 is the most economical material for crushing rolls (see Table 1).

The advantage of additional roll life, obtained by the use of highly abrasive-resistant materials, is more than offset by increased difficulty of grinding. On forms where extreme sharpness of corners is not required, free-machining steel or close-grain cast iron may be used. Since these soft materials wear much more rapidly, it is necessary to recondition the roll more frequently. A shaving tool in a slide built into the crushing-roll fixture is a practical method of reconditioning soft rolls.



Grinding the form as in the upper view is difficult because of the vertical side *A* and the additional depth of *X*. A setup as in lower view is preferable, because it eliminates all vertical sides and reduces depth *X*

Use of Two Rolls—When hard material is used for the crushing rolls, form life is prolonged by the use of two rolls. A work roll is used for the initial crushing of the grinding wheel and for subsequent truing or dressings between grinds. When the work roll loses form beyond tolerance, the grinding wheel is trued or dressed on a reference or master roll. The work roll is then reground to its initial form and production is continued.

Suitable Grinding Wheels—See Table 2 for grinding wheel selection. For crush dressing, the speed of the grinding wheel should be reduced to 250 to 300 sfpm for economy, although the rate of crushing-roll wear increases very little up to three times this speed.

Crush Dressing—The grinding wheel should be brought into driving contact with the crushing roll with both members at rest. A preload of 0.002 to 0.020 in. will develop between wheel and roll as crush dressing proceeds. This will vary with the grade and width of the grinding wheel, the rate of crushing, and the rigidity of the machine. This preload should be maintained constant for any one wheel to avoid concentration of stress which would result in breaking or spalling of the wheel.

Life of Rolls—The life of crushing rolls is proportional to the depth of form. A cylindrical roll having no contour will last ten times as long as one having 0.025 in. depth of contour (see Table 1). Very deep forms are impractical to crush dress. With a high-speed-steel crushing roll equivalent of 20-pitch thread form, 0.001 in. of roll wear occurs after approximately 0.175 in. of wheel dressing.

Checking Contact—The crushing roll can be marked with layout fluid, crayon pencil or other suitable means to show if all surfaces are in contact. The rate of crushing feed is 0.001 in. for 2 to 5 revolutions of the grinding wheel, depending on wheel hardness. All unnecessary rolling contact between wheel and roll should be avoided to result in optimum roll life.

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Contour Grinding with Crush-Dressed Wheels...II

Coolant—Best results are obtained in crush dressing by using an ample supply of good grinding oil directed to the point of contact between wheel and work (5 to 8 gal. per in. width of wheel). Very often open forms without sharp corners can be crush dressed using a soluble oil. Where coolant is not permissible, a copious blast of clean, dry air can be used. Since the coolant acts as a lubricant in crush dressing, the roll life is reduced when the process is performed dry.

Width of Form—There is no limit to width of grinding wheel that can be crushed other than the limits of the machine. In grinding extreme wide parts, care must be taken that the temperature rise produced does not distort the parts beyond tolerance.

Pitch of Serrations—Fineness of serrations that can be contour ground is limited only by fineness of crushing roll. Thread forms as fine as 100-pitch; or 90° included-angle serrations as fine as 400-pitch are practical.

Slot Grinding—In crush-dressing a wheel for grinding vertical-sided slots, it is best to build up the crushing roll from a series of disks or washers. By this method, sides can be maintained within 0.002 in. per in. (7 min.) of vertical. Maximum ratio of slot depth to width is approximately 10:1. Slots as narrow as 0.010 in. can be ground.

Balance the Form—Where a contour has straight and curved or angular sides, the setup should be made at such angle as will balance the form (Fig. 1).

Table 1... RATE OF CRUSHING-ROLL WEAR

DEPTH OF CONTOUR, IN.	Rate of Roll Wear for Different Materials (0.001 in. Wear Per Wheel Dressing)			
	18-4-1 H.S.S.	W 2 H.S.S. M 2 H.S.S.	TUNGSTEN CARBIDE	MEEHANITE OR SOFT STEEL
0.000	0.0005	0.0001	0.0002	0.001
0.025	0.005	0.0046	0.0025	0.008
0.050	0.010	0.0095	0.005	0.016
0.100	0.020	0.019	0.010	0.032
0.200	0.040	0.038	0.020	0.060
0.400	0.080	0.076	0.040	0.125
0.800	0.160	0.150	0.080	0.260

Table 2... SELECTION OF GRINDING WHEELS FOR CRUSH DRESSING

Grain Size		
GRAIN SIZE	SIZE OF RADIUS AT ROOT OF FORM	THDS PER INCH
500	0.001	100
320	0.002	36
280	0.003	24
220	0.004	16
180	0.005	10
120	0.007	6
80	0.010	

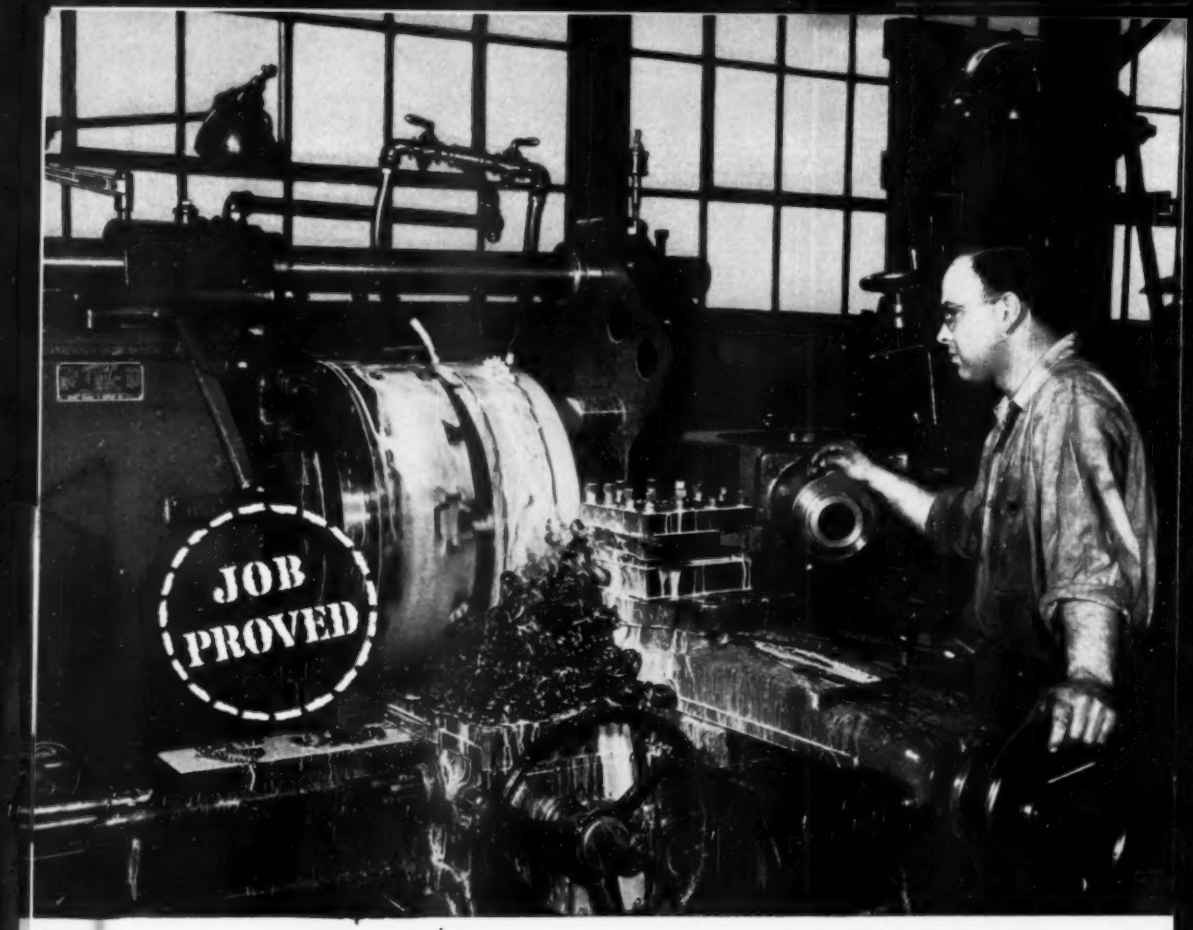
Grain Type—Silicon carbide is used for molybdenum high-speed steels; high-carbon, high-chrome steels and most grades of Stellite and Tantung. Aluminum oxide is used for non-ferrous metals, and for steels up to including 18-4-1.

Grade—Wheel hardness depends on table feed. Grade "G" is considered best for heavy cuts at 2 to 10 in. feeds, but "H" or "F" may be used. For light cuts at 50 to 100 fpm, Grade "J" is general purpose.

Structure—Most open standard structure is desirable, but not extra porosity secured by use of fillers.

Bond—Vitrified bond is suitable; resinoid bond is unsuitable.

Grit Size—This depends on sharpness of corner at root of form. Finish is controlled by surface finish of crushing roll and coolant cleanliness.



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Competitive Product Fails to Match Fine Record of Sunoco Emulsifying Cutting Oil in Cost or Performance

For 27 years a metalworking shop used Sunoco Emulsifying Cutting Oil with complete satisfaction on difficult operations. The following is a typical example:

Machine: Gisholt turret lathe, model 4L.
Part: 20" press mold shell 22⅛" O.D. x 6" wide x 20½" I.D.
Operation: Turning, boring rough forgings.
Material: 40-50 carbon steel.
Tools: Firthite carbide tools.
Feed: .012 at 31 rpm.
Cut: ½" to ¾" on O.D. and boring.

Tool life was excellent. Machines stayed clean. High production, with minimum scrap, was the rule year in and year out.

Two years ago the shop was persuaded to try a competitive oil on the above operation. Test results showed that the competitive oil, costing three times as much, lacked stability. Performance was far inferior to that of Sunoco Emulsifying Cutting Oil in regard to tool life and quality of finish. The company was quickly convinced that its original choice had been sound.

In all machine shop operations, on both ferrous and nonferrous metals, you'll find Sunoco Emulsifying Cutting Oil and Sunicut* straight cutting oils of real assistance. They help maintain production schedules, lengthen tool life, and keep operating costs down. For a free Sun cutting oil recommendation card, write Dept. AM-8.

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American Machinist

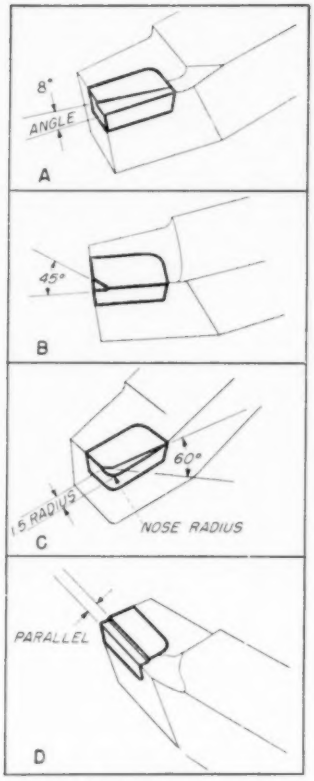
Chip Breakers for Carbide Tools

Abstracted from the "TOOL MANUAL" published by CARBOLOY COMPANY, INC.

WIDTH OF PARALLEL AND ANGULAR-TYPE GROUND IN STEP CHIP BREAKERS

DEPTH OF CUT (Inches)	FEED-IN, PER REV.				
	.009-.012	.013-.017	.018-.022	.023-.027	.028-.032
	WIDTH OF CHIP BREAKER				
1/64 - 3/64	1/16	5/64	3/32	7/64	1/8
1/16 - 1/4	3/32	1/8	5/32	11/64	3/16
5/16 - 1/2	1/8	5/32	3/16	13/64	7/32
9/16 - 3/4	5/32	3/16	7/32	15/64	1/4

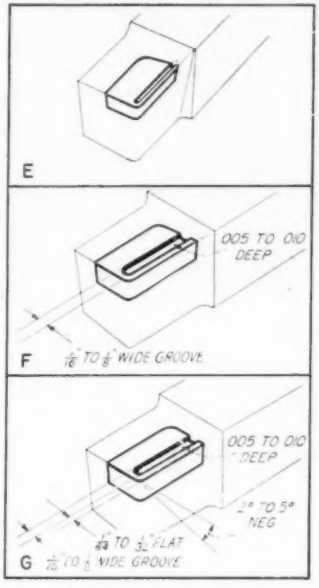
NOTE: A chip breaker depth of .020 is satisfactory for most types of steel.



Ground-In Step Type—This is the type of chip breaker most widely used.

Angular Type—Forces chips to curl away from tool point and clear the shoulder of the cut. Chip characteristics are controlled by angle, depth, radius and width of step. Angle, as at A, is usually 8°; depth between 0.015 and 0.020 in.; radius should not exceed depth; width is varied to control chip curl—narrow for tight curls; wider for loose curls and heavy feeds. For finishing cuts, a chip breaker, B, may be ground at 45° across the tool nose and 1/16 in. wide. If nose radius exceeds the width, a second step, C, at 60° to the cutting edge is ground, and of a length equal to 1½ times radius.

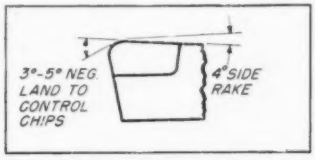
Parallel Type—When stock is eccentric, producing irregular depth of cut, a parallel ground-in step, as at D, is most effective.



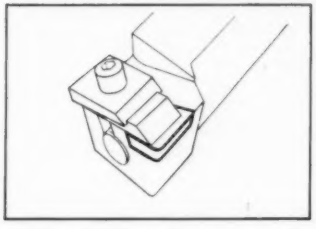
Ground-In Groove Type—This type of chip breaker is extensively used for roller turner, or box tools, because the well-coiled chip is unlikely to fall between the rollers and the finished work surface.

A shallow groove, as at E, is ground parallel to the cutting edge and often stops short of the end.

Ordinarily the groove, as at F, is 0.005 to 0.010 in. deep by 1/16 to ⅛ in. wide. The flat, as at G, between the cutting edge and the groove, is 0.015 to 0.030 in. wide, and a negative side rake of 2° to 5° is used.



Negative-Rake Angle Type—Chip control can be obtained with negative rake angles ranging from 3° to 5°.



Mechanical Chip Breakers—A clamped-on chip breaker is feasible if the tool is large. Precision fit of the contact surfaces is required to prevent entrance of metal particles between the chip breaker and tool.

There are four basic methods of creating an obstruction to chip flow on single-point, carbide-tipped tools. One of these methods is essential in order to control the shape and the length of the chip, particularly when machining steels, and some of the bronzes and the aluminum alloys. A chip breaker is not required when machining the "short-chip" materials, such as cast iron, brass and nonmetallics.

How accurate is accurate?

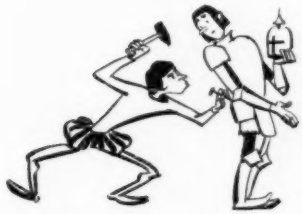
Here's one answer . . . 1/10,000 of an inch . . . a closely held tolerance common to production grinding. Here's another . . . 10 micro inches . . . a measurement of surface quality. Your cost man has still another . . . the dollar ratio between wheel cost and work ground.

Whether *you* measure accuracy in terms of production or maintenance grinding there's a Simonds Abrasive Company wheel, proper in grinding characteristics . . . accurate in specification . . . produced under complete, accurate quality control and rigidly tested to measure up to your job needs.

Write now for Data Book describing our complete line and listing your nearby Simonds Abrasive Company distributor.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN PRINCIPAL CITIES

TALKING SHOP



Olive Oil & Leather

HUGH, the armorer of Rouen, was quite a fellow back in 1431. He made armor without pockets to catch a weapon point and with joints so closely riveted that a dagger couldn't enter. But, best of all, his armor could turn any blade, because the wrought iron, after shaping, was packed in green-wood chips in a fireclay box and heated, quenched in water, then reheated to blue and drawn in olive oil. This last step was a secret, according to Lawrence Schoonover, in "The Burnished Blade," published last year. But the finest swords and the finest helm Hugh ever made were meteoric iron, put in the fireclay box with well-tanned leather—or leather ashes—instead of chips.

To harden a breastplate or other piece, Hugh forged steel wire into the surface. If you want to recall thirty—or 500—years ago, when heat-treating was full of secrets and hocus-pocus, you'll enjoy this tale. It even disillusioned us on a couple of deep secrets the local blacksmith taught us years ago.

Transfer Machines

"TRANSFER" means to most people a certificate permitting a change in direction of transportation. But automotive companies are now questioning just that aspect of their transfer machines, many of which are designed to multiple-machine one specific part and must be scrapped when that part is abandoned or changed. New transfer machines will be bought, but now with the proviso that the transfer machine itself be transferable—that its parts be adaptable to new production rather than too highly specialized. This is part of a campaign to get longer life from machine tools as well as tools themselves. Look for standards on spindle noses, cutters, jigs, fixtures, toolholders, and the like—so they can be transferred instead of scrapped when models change.

Type-Metal Templets

IN MACHINING on a duplicating machine or a profile grinder, both male and female templets may be needed. Only one need be made—the other can be cast in type metal from it. Pratt & Whitney Tool provides flasks for such casting as an accessory to the Keller machines. The steel templet itself provides the pattern and the type metal is poured directly against it. Almost no finishing is needed—the cast templet is accurate to tenths—because the antimony content causes the type metal to expand against the steel templet as it cools.

Teach By Example

HOME TALENT is better than educators for teaching in industry, according to the results of a joint educational project begun in 1945 by International Harvester and the University of Chicago for Harvester employees. Next year the University will issue the first of a series of reports on the project, explaining how teachers are selected and trained and providing a blueprint for improving employee educational programs. Indications are that the man who can do the job can better teach others, because he does it by providing himself as an example. Further, most employees with high-school education or less are eager to learn more about their jobs—on their own time. These experiments indicate that such training gives the individual an opportunity for self-adjustment of personal problems, and results in a more-efficient worker.

Problem Solver

GOT A PERSONAL—or personnel—problem, friend? Brake Shoe Yardsticks, a booklet written by William B. Given, Jr., president of American Brake Shoe, is a swell guide for measuring the day-to-day decisions that make life so complex. It's in cartoon form, with sentences that make sense, and humor all the way. Free for the asking from American Brake Shoe Co., 230 Park Ave., New York 17, N. Y.

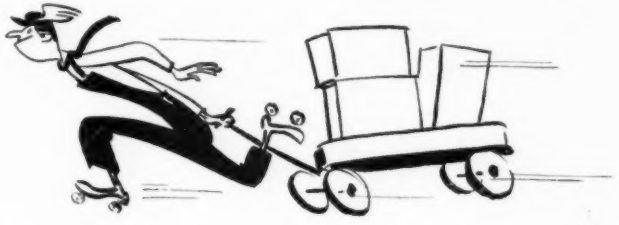
Two-Millionth Slice

DR. E. F. FULLAM, G.E. research scientist, has cut a 0.000002-in. slice of metal. Cutting was done by a shock wave forming in the sample ahead of a knife blade moving with the speed of sound. He calls his instrument a "high-speed microtome," has been experimenting with it for several years. Two years ago, he achieved a rotational speed of 123,000 rpm with one, has since cut all sorts of tissues with microtomes.

Popgun

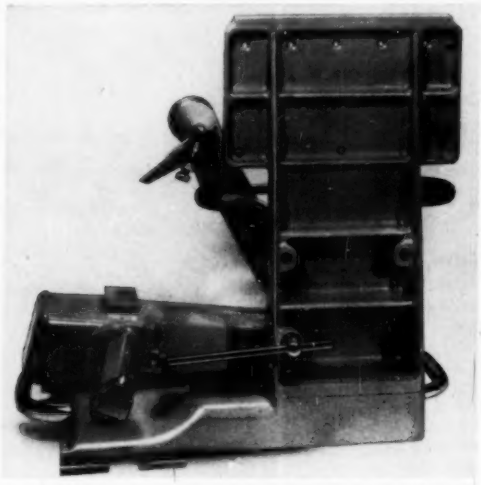
GENERAL ELECTRIC has just announced that a column of oil can replace a punch in blanking and piercing silicon-steel sheet, and that the die can be soft steel instead of tool steel. Any kid with one of those paper popguns knows as much—just as does any youngster who's been too close to a fire hose. But in the process of growing up, we've all forgotten it. Maybe some other childhood ideas and equipment deserve study.

Which reminds us that the plants in Springfield, Vt., are still making effective use of child's coaster wagons for transfer of small packages, parts and orders between departments. The newest are trimmed in red and carry the name "Rocket Express." So Buck Rogers is in the shop now, too.



New Shop Equipment

1 *Wheel-forming attachment has 10-1 pantographic motion, both for rotation of tracer (to adjust angle of attack of diamond) and for contour following. Lower bar is for handling, upper a fiber-faced guard for the tracer arm. Note clamp blocks at lower right*



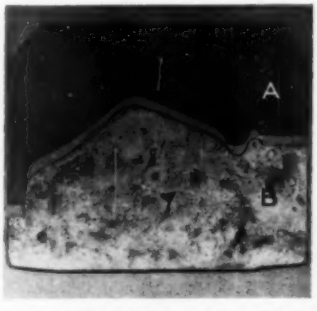
2 *In this view, centering gage, tracer guards, tracer point and diamond arrangement can all be clearly seen. All major parts are aluminum castings and bearings are fully inclosed. Back of templet panel is at upper right*

Diaform Attachment Dresses Wheels to 0.005

CONTOUR GRINDING WHEELS may be dressed within 0.0005 in. or less with the Diaform wheel-forming attachment. The unit can be mounted on any horizontal surface grinder, either by placing on a magnetic chuck or by clamping to the grinder table. It dresses the wheel on its own spindle on the under side of the wheel at the point of grinding, so minor errors in the wheel spindle are compensated for.

The dresser is essentially a fixture by which the dressing diamond is guided by a 3/32-in. thick templet made in the ratio of 10-1 to the finished work. Following the 10-1 templet is a hand-operated pantographic arm which has a tracer point of ten times the dressing-diamond radius. Tangent guardplates on this tracer indicate the axis of the diamond at all times and have an included angle slightly greater than the diamond

3 *Attachment has its own carrying box, with drawers for indicator and mount, diamonds and holders, guard plates, draw-in bolt, tracer points, 40° and 60° tracer guards and setting gage, guard clamp wedge, lubricating gun, and three Allen wrenches. Weight is 35 lb*



4 *Templets of 3/32-in. stock are 10 times desired wheel contour. If mating parts are involved, the second templet can be cast in type metal with the first as a pattern. Templet is located by top and left edge. For wheels over 1 in. wide, several templets are used in turn*

5 *Diamonds are set to height in standard holders against gage blocks. Holders are held by a diagonal thumbscrew that pulls them tightly into an angle (as shown), and adjusted laterally by the second thumbscrew so the diamond can be centered to zero run-out against a tenth indicator*

Materials and Parts

mount, thus preventing grinding into it, as well as permitting most-efficient and accurate dressing direction. Thus any tool or die maker can operate the unit.

The standard templet is positioned by a side pin and top bar (parallel with the base) so templets can readily be interchanged and the dresser moved from machine to machine, handling several dressing jobs in rotation. The attachment will form-dress to a depth of ½ in. on wheels up to 10 in. in dia and 1 in. wide. For wider work, increments of the whole profile are dressed into the wheel progressively.

The unit operates at a 10 to 1 ratio, so diamonds and tracer points are in that ratio as well. Usually, three diamonds, roughing, of 0.030-in. radius, finishing of 0.010 in., and finishing of 0.005 in., are used, depending upon the contour to be dressed. Tracer points are 0.600, 0.200 and 0.100 in. in dia, and are readily interchangeable in the tracer head. They are taper-shanked and held by a draw-in bolt. Diamonds are chisel-shaped, mounted to rock about the tip radius so they always dress the wheel in proper position. Each diamond holder is in a block set for depth against gage blocks (constant plus diamond radius) and centered by indicator when mounted. A 0.0001-in. dial indicator and mounting bracket are provided.

There are no sliding parts in the dresser, and balance is such that tracer pressure is quite light. Bearings are protected against damage from abrasive particles and a 1-shot lubrication system is built in.

Tracing pressure is always upwards or sidewise against the templet. Both male and female templets may be required for mating parts. In this case, the second may be cast in type metal with the first as a master profile. Thus only one templet need be stored for any job.

Alignment plates in the attachment base permit lining up as well as providing adequate holding means on magnetic chucks. A single centering gage is built into the base so the center of the diamond may be aligned with the wheel-spindle center. Rake and clearance angles may be ground into a form wheel by offsetting the diamond a distance equal to the wheel radius times the sine of the desired offset angle. The centering gage is graduated for this purpose.

In dressing, the wheel is first roughed, then finished. After the work is rough-ground, the wheel is refinished, with wheel wear on a normal hard tool-steel job being of a minor nature. Finish-grinding will bring the job to an accuracy as fine as 0.0005 in.

Base dimensions of the unit are 11¼ x 5¼ in. It is supplied in a 15 x 20¼ x 22¾-in. storage cabinet which also includes drawers for accessories.

Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford 1, Conn.

6 *To center diamond under wheel axis, a built-in gage is read at the diamond center, then lifted to spindle center and the grinder table adjusted to same reading. For dressing rake and clearance angles, diamond is offset by formula. The gage is graduated for this*

7 *Tracing point is ten times diamond radius and carries tangent guard plates to prevent grinding into the diamond mount. As point and guard plates are swiveled, the diamond holder follows. At right center are 1-shot lube hole and indicator mount for "zeroing" the diamond*

...INCLUDING

Gear-finishing machine for spur and helical gears has cutter set at an angle relative to work, page 148

Electronic contour-following system guides machine to cut out metal parts according to the drawing.....page 150

Aluminum is brazed to steel by a low-cost method offering strength and broad adaptability..page 150

Continuous-limit gage controls thickness of sheet metal, protects metal-stamping dies from injury .....page 152

Improved turret lathe has turret-locking mechanism which indexes head within ±0.0005 in. measured 4 in. from turret face....page 154

Small-hole gages measure diameters, width of slots or grooves, below 5/16-in. range.....page 156

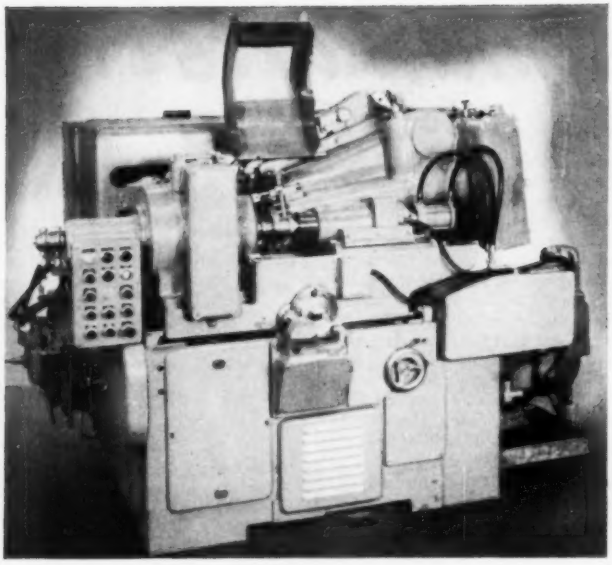
Straddle-truck extension shoes increase possible length of palletized loads, eliminating special large skids or platforms.page 158

...and in August 25

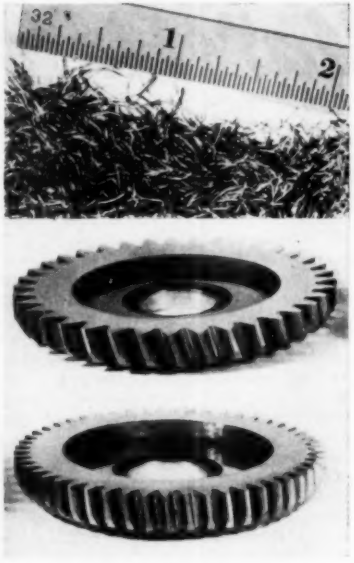
Automatic work loader raises efficiency of straight-bevel and hypoid gear generators.

Improved plastic molding machine has low injection pressures of 3000 to 5000 psi.

5-in. 4-spindle automatic offers flexibility of changeover.



1 *Fellows No. 12 gear finisher employs shaper-type cutter which takes actual chips. There is no burnishing effect on work. Cutter finishes both sides of the teeth in one traverse*



2 *Chips removed, top, indicate free cutting action of machine. Center—cutter is for a helical gear; bottom, for a spur gear*

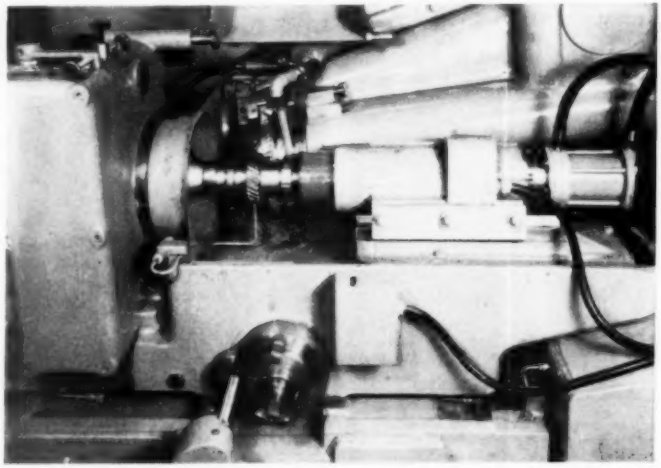
Gears Finished by Crossed-Axes Cutting

Operating on a new principle, in which the cutter is set at an angle relative to the work, this new machine finishes spur and helical gears. Cutters have teeth of helicoidal shape which are sharpened by face grinding in a manner similar to spur gear-shaper cutters. Cutter finishes both sides of the teeth in one traverse. Although it is possible to remove more stock from the sides of the teeth than with conventional methods, cutter life is prolonged by keeping amount of stock to be removed to a minimum.

Finish on teeth is governed largely by the traverse feed of the cutter, and the feed can be varied through change gears, making any desired finish possible. The traverse feed, within reasonable limits, has no effect on accuracy of gear produced.

Machine is designed so that air-operated work-holding fixtures can be applied for clamping and unclamping the work, and it is also provided with a tailstock for supporting stem pinions. The machine stops automatically when the cutter completes the traverse of the work, the cutter remaining in contact with the work. The finished gear is then removed and an unfinished blank inserted, the cutter thus acting as a setting gage for locating the teeth on the work relative to those on the cutter.

Operating cycle is: When the gear is completed, the machine stops automatically and the work backs away from the cutter an amount equal to the depth of cut. Operator elevates the safety guard, which breaks contact with the button controlling the air-operated clamping mechanism. He removes the finished gear, and inserts an unfinished gear, the cutter acting as a setting gage.

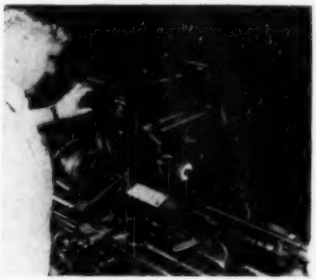


3 *Close view shows setup for finishing an external helical gear. Machine is automatically lubricated and has magnetic separator preventing chips from being carried in cutting oil*

preparing the machine to start as soon as the safety guard is lowered. Cutter and work start rotating with a light clamping pressure on the work. After a short interval, full clamping pressure is applied, and at the same time, work withdraws from cutter, and cutter is rapidly traversed across the work to the starting point. Work is then automatically advanced to depth of cut and cutter is traversed across work at the desired feed. The machine is automatic in operation, with the exception of loading and unloading.

The magnetic chip separator prevents chips from being carried in the cutting oil and thus marring the finish. Capacities are: Maximum pitch diameter of work, 12 in.; maximum OD of work, 12½ in.; maximum diametral pitch, 5; maximum OD of cutter, 7¼ in.; maximum face width, 8¾ in. (for gears over 9 in. dia it is 6½ in); maximum helix angle, 45°. Over-all dimensions of machine are 7½x6-1/12x5¼ ft. Net weight including motors and chip separator is approximately 11,700 lb.

The Fellows Gear Shaper Co., Springfield, Vt.



Speed Control Operates DC Motor from AC Line

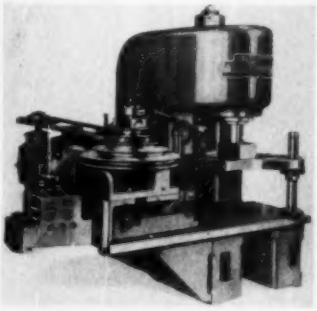
Operating a 1/3-hp dc shunt motor from an ac line is simplified by use of this low-power, compact, single-unit speed control.

Constant field voltage is supplied by a dry-disk rectifier, while the armature voltage can be varied by a Variac autotransformer feeding an electronic rectifier. Smooth control is obtained from motor-rated speed down to practically zero. Regulation in rpm is constant at all speed settings.

Ac ripple in armature circuit is said to be far less than that in a thyratron control. Overload capacity for starting is several times full-load armature current.

A single box, 9x12x4½ in., is used to house both control and manual stop-start reverse switch. Dynamic braking is provided in the stop position.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.



Stock Feed Accessory Steps Up Multipress Production

Automatic feeding of stock strip to punching dies by this Harmonic stock feed accessory, steps up production to as high as 50,000 pieces per hr. The several models of the accessory provide wide, stepless variations in speed and feed characteristics within limits of equipment.

Coil stock up to 3 in. wide and 3/64 in. thick may be fed up to 3 in. per stroke by the accessory. Tonnage, preset before operation is started, is applied with identical pressure for each successive stroke, as the accessory feeds the strip under the pressure ram. Stroke is not fixed. Stroke length of press ram is adjustable from ⅛ in. to 2½ in.

Accessory is available for use with Multipresses up to 8-ton capacity. An accuracy of ± 0.002 in. is said to be maintained with equipment.

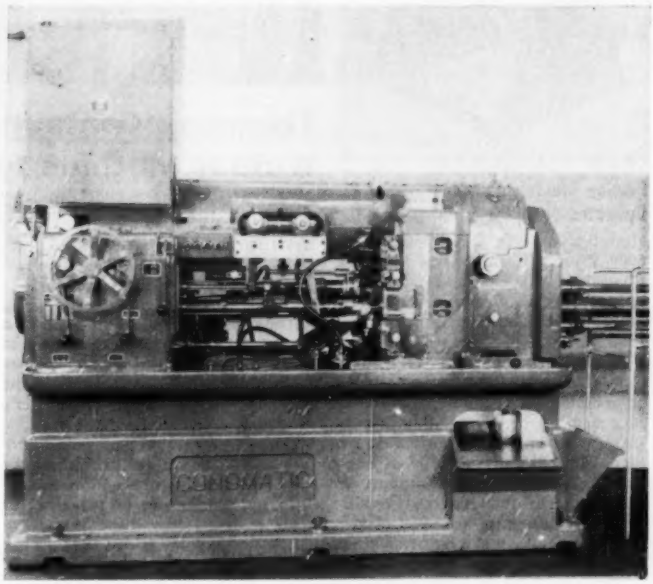
The Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio

Metal-Surface Coating Resists Heat to 500F

Coating for finishing, protecting and decorating exposed parts of machines has been developed for heavy duty, luster, long wearing, and rust-resistance.

Marketed under the trade name of "Oncrete for Concrete," the free-flowing coating is touch-dry in 30 min forming a durable glossy finish that does not scale, crack, check, or dust off. It can be sprayed or brushed on. Coating resists heat up to 500 F. A variety of colors are available.

Lowebco, Inc., Chicago, Ill.



1-IN. SIX-SPINDLE Conomatic, Model SL, handles short, medium, and long runs of ferrous and non-ferrous material, with HSS or carbide tools. Design positions all cams free of tooling and base areas. Change of working travel of the six standard cross-slides and main end-slide is accomplished by resultants from movements of each slide and its respective cam roll. Turning of graduated dials establishes working travel of slides as well as stock feed. Flexible power-feed transmission offers selective feed combinations to 225, between 30 and 943 work-spindle revolutions—*Cone Automatic Machine Co., Windsor, Vt.

The start button is depressed, which operates the clamping mechanism,

Aluminum Brazed to Steel

This method of brazing aluminum to steel offers great strength and broad adaptability. Technique is said to be simple and low in cost. Possible applications include brazing of aluminum cooling fins to steel engine and compressor cylinders and fabrication of assemblies in which the special properties of steel inserts are combined with lightweight and corrosion-resistant advantages of aluminum. All three Salkover plants offer engineering analysis of proposed applications.

Salkover Metal Processing, 321 Dixie Terminal Bldg., Cincinnati 2, Ohio

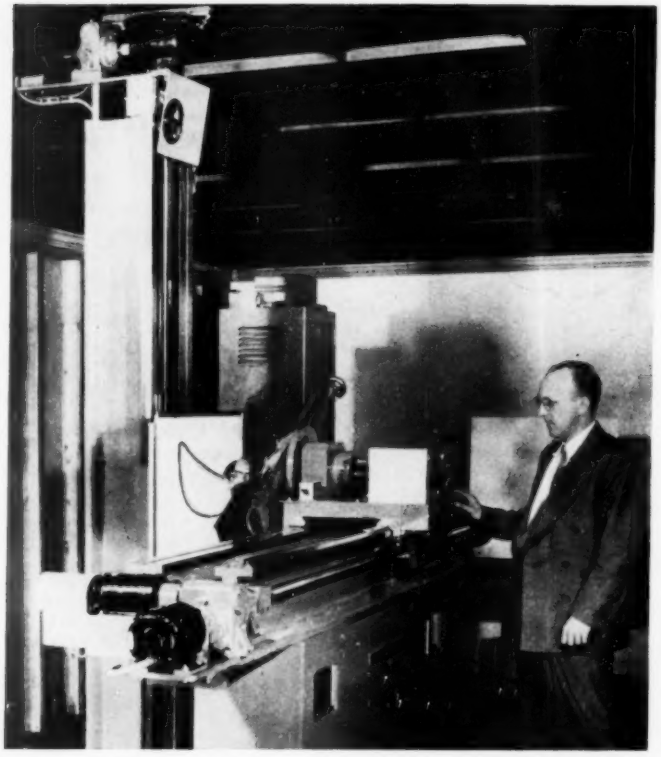
Pereny Electric Furnace Operates to 3500 F

High-temperature operation up to 3500 F under a neutral or reducing atmosphere is featured with this electric furnace. Recommended average working temperature is approximately 300 F with the maximum peak of 3500 F for short cycles.

Steel case of the unit is designed to maintain a vacuum of 30 in. of mercury. Furnace can be positioned either horizontally or vertically. Design is such that inner or primary tube containing the molybdenum element may be removed readily without disturbing furnace proper. Element is designed to compensate for heat gradient at tube ends.

Working area of furnace is 2 in. ID by 28 in. long, with an 18-in. controlled-temperature length. It has one open end with a 10-in. vestibule or sight tube. Model MO-224 has conections for neutral or reducing atmospheres, vacuum and water.

Pereny Equipment Co., 893 Chambers Road, Columbus 12, Ohio



Electronic Contour-Following System Guides Machine to Follow Drawing

This electronic contour-following machine can follow the lines of a drawing with an electric eye and guide a machine tool to cut out metal parts according to the drawing.

Called the GE contour-following system, the device is connected to a machine called a slave unit, so that the machine's cutting tool reproduces in metal the drawing seen by the electric eye. As eye moves along the lines of a drawing, the position of the cutting tool is changed accordingly by means of an electronic servo system, which emits signals to control the leadscrews of the machine tool.

The equipment is expected to find application in fields where small quantities of relatively expensive pieces must be produced to close tolerances. In use, an exceptionally accurate drawing is reproduced on a metal plate. Control then operates to guide machine tool in accordance with the lines of this plate, eliminating much of the layout time, as well as the need for templets or patterns.

Equipment is capable of following a line in the form of a closed loop with a diameter as small as 0.06 in. It can scan the line of a drawing through a low-power microscope at a speed of 0 to 6 ipm. When line is in center of the microscope's field, the eye sends out an electrical signal at a frequency of 60 cycles per sec. A 26-tube electronic circuit picks up this signal.

Microscope and electric eye are placed on a movable mount which rests on a lathe bed. Drawing to be reproduced in metal is set a fraction of an inch from the microscope on another movable mount. When line to be followed travels to the left or right, the microscope and eye move in their mounts to follow it. When the line travels up or down, the drawing itself changes position. Motions are transmitted electrically to controls on slave unit. Because of range of reduction ratio (3.75-1 to 60-1) error in finished piece cut by slave unit is less than 0.001 in.

General Elec. Co., Schenectady, N.Y.

AMERICAN PHILLIPS SCREWS

. . . bring Profits into Sharper Focus

. . . both in Production and Sales of Photo Equipment

SHARP FOCUS ON COST-CONTROL: Lights, cameras, and other tools of the glamorizing trade are liberally studded with that modern quality-mark — the universal crossed recess of American Phillips Screws. Makers of this costly photographic equipment can't afford rejects or refinishing . . . and they can't afford slow, old-fashioned assembly with slotted screws. They find . . . as so many cost-conscious manufacturers in *all* lines have found . . . *that American Phillips Screws always cost least to use.* For time-savings alone run as high as 50%!

SHARP FOCUS ON SALES: American Phillips Screws have built up a huge and faithful public who know that the universal crossed recess means *quality throughout* . . . and that the product is put together to stay. These assurances, added to their definite decorative value, make American Phillips Screws a feature to be *profitably promoted* in any selling effort. Care to have us show *you* how? Just write:

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

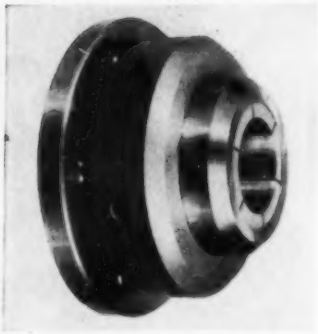
Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Building

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)



Non-Magnetic Chuck Utilized to Inspect Electrical Parts

Every part of this Standard faceplate collet chuck except the knurled spanner lock nut is of non-magnetic conductor material. Chuck has been developed for inspecting electrical parts.

Current must flow through collet chuck freely for exacting inspection of electrical part. Concentricity must also be held during inspection.

Erickson Tools Div., 2311-A Hamilton Ave., Cleveland 1½, Ohio

Compact Switch Operated By Foot, Finger, Knee, Elbow

This treadle-type switch is small, light, yet sensitive.

Mechanism can be operated by foot, finger, knee or elbow. The Linemaster compact switch is made of heavy-gage steel, has a black crackle finish, a cork composition, non-skid base, and weighs 6½ oz.

Simmons Machine Co. Inc., Southbridge, Mass.

Welding Goggle Has Nylon Cups

Less weight and greater strength are obtained in this welding goggle by the use of nylon plastic cups. Goggles feature rolled edges, adjustable leather bridge, triangular lenses, and indirect ventilating ports. Goggles are also available with direct ventilating ports and clean, impact-resisting lenses for chipping and other heavy-duty work.

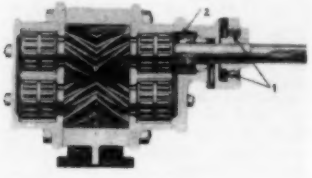
Willson Products, Inc., Reading, Pa.

General-Purpose Winch Is Planetary-Gear Type

Planetary-gear-type winch can be mounted in any position on a flat surface, 5x5¾ in. Mechanism is contained within the winch drum.

Drum is 4 in. in diameter, its flanges 6 in. in diameter, and overall length is 6¼ in. Crank handle is 12 in. long and grip can be swung out of way when not in use. Direct cable pull is 600 lb. Each revolution of the crank winds 3 in. of cable. A positive-acting brake holds load in position and prevents spinning of handle when crank is being turned in reverse direction.

Lewis-Shepard Products Inc., 268 Walnut St., Watertown 72, Mass.

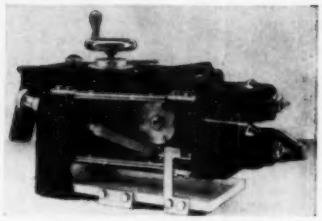


Rotary Pumps Provided With New Inboard Bearings

Inboard-bearing construction on the GR herringbone-gear rotary pumps takes load off main pump bearings.

Bearing is an adapter type designed so that inner race is locked to driveshaft close to load center arrow 1). This feature eliminates necessity of user installing separate outboard pedestal bearings and base. Also incorporated is a drip-proof mechanical seal (arrow 2), adjusted automatically and subject to suction pressure only.

Worthington Pump & Machinery Corp., Harrison, N.J.



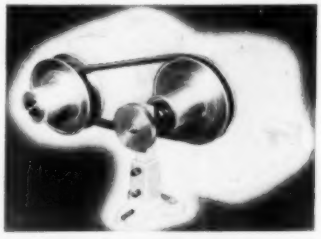
Continuous Limit Gage Controls Thickness of Sheet Metal

To protect metal-stamping dies from being injured by material that is too thick, a new continuous limit gage has been developed. Gage indicates by a signal light, controlled relay, or similar device, when strip or sheet material is too heavy.

Thickness of the material or amount of variation is not shown by gage. Rather, it indicates that material is light or heavy, not both.

When this gage is used with a diestamping press or similar machine, it will send out a signal or impulse that will stop operation. Gage provides a means of inspecting continuous strip material where it is desired to control only one limit, high or low. Range is from 0 to 0.300 in. with an accuracy of 0.0005 in.

Pratt & Whitney, Div. of Niles-Bement-Pond Co., West Hartford, Conn.



Variable-Speed Control Unit Offers a 6:1 Ratio

This variable-speed control unit using standard V-belts, with fixed centers at any distance, is available with either 1 or 2 hp, and has a 6 to 1 ratio.

Assembly includes 2 variable-pitch sheaves and control. A spring-loaded sheave is mounted on motor shaft while control sheave is mounted on the driven shaft. Regulating mechanism consists of a hand wheel and bracket, adjustable to any application. Changes in pitch diameter cause V-belt to actuate spring-loaded motor sheave, giving stepless speed control over the 6 to 1 range. Remote control can be applied.

Speed Selector Inc., 118 Noble Court, Cleveland 13, Ohio

Want to cut costs on parts like these?

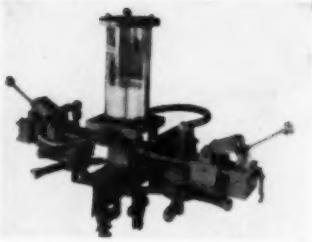
Broaching has cut costs on every one of these parts, as on many hundreds of others, reducing floor-to-floor time, cutting idle time of machines and operators for tool changes, improving accuracy and maintaining it. It's really remarkable how little time Colonial broaching equipment takes to pay for itself.

PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

Have a Colonial Representative check over your parts for ways and means to cut costs by broaching. Write or wire now, before you forget it.



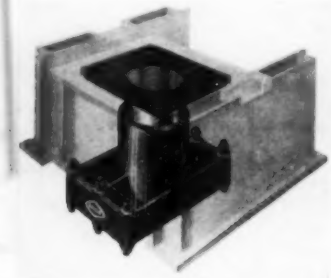
Self-Contained Lubricator Designed for Conveyors

Conveyors requiring no external power for operation can be lubricated by this self-contained grease unit.

As trolley wheel approaches lubricator, hub engages sleeve of one of five pumping units, which is automatically brought into contact with wheel bearing. Continued rotation of lubricator forces pumping unit inward, delivering a measured quantity of lubricant through fitting to the wheel bearing. A cam located in the pump housing snaps the next pumping unit into position for greasing. Process is continuous as long as conveyor is in motion.

Unit will operate on conveyor wheels equipped with or without Zerk hydraulic fittings.

J. N. Fauver Co., 49 W. Hancock, Detroit 1, Mich.



Pneumatic and Hydropneumatic Die Cushions Available for Presses

Pneumatic die cushions offered in standard sizes from 4 through 28 in. dia in the single-piston type and from 10 through 30 in. dia in the double-piston type are now available in the Baker machinery line.

Size and number of cushions in a given installation depend on the individual press bed construction and pressure requirements. Cushions are self-contained and can be supplied to fit any press, regardless of size or make.

Baker Bros. Inc., 1000 Post St., Toledo, Ohio

Turret Lathe Again Available

Refinements in design have been incorporated in the post-war models of South Bend No. 2-H turret lathes. Included is a turret-locking mechanism which indexes turret head within ±0.0005 in. measured 4 in. from turret face.

Designed for production of duplicate parts, the lathe can be equipped with universal or independent chuck for machining castings, forgings or other parts. It can be equipped with hand-lever draw-in collet attachment for machining bar stock or tubing. Maximum swing over bed is 16¼ in., over cross-slide 6⅞ in.; maximum collet capacity is 1-in. round, and hole through spindle is 1⅜ in. Hexagon turret has 1½-in. dia holes for turret tools. Clearance from center of tool hole to top of turret slide is 2½ in. Effective feed of turret slide is 6⅛ in.

Wide ranges of speeds and feeds are available in the machine. The 12 spindle speeds range from 16 to 880 rpm. Use of a two-speed motor permits quick change from high to low speeds for reaming and tapping operations.

South Bend Lathe Works, South Bend 22, Ind.

Portable Telescopic Conveyor Features Uniform Slope

Step-down between conveyor sections is eliminated by locks of the recently developed portable telescopic conveyor. No bolts or clamps are used, but the locking arrangement correctly positions sections.

Conveyor is made in wheel or roller type. It is stated that the unit eliminates much of the hand and footwork previously required.

Wilkie Co., 5520 Arch St., Philadelphia 39, Pa.

Internal Exhaust Core in Valve Disk Eliminated on Foot Valve

Two redesigned foot valves, the Model F and Model R Nopak foot valves, have several installation and operating advantages. Principal change is the elimination of internal exhaust core in valve disk. Lower over-all height of valves and elimination of side exhaust ports give them a more compact appearance. Valves can be used as two-way shut-off valves, or as 3- or 4-way operating valves. They can be adapted to oil or water for pressures up to 100 psi, although primarily designed for air service.

Galland-Henning Mfg. Co., Milwaukee 7, Wis.

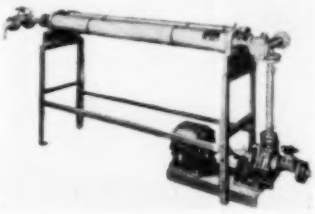
Pneumatic Reversible Screwdriver Handles Small Screws, Fasteners

Designed to speed production jobs that require driving many small screws and other fasteners, a recently developed screwdriver is scarcely larger than a fountain pen.

It is claimed that its small size, light weight and freedom from torque reaction combine to make for easy handling. Operator fatigue is reportedly reduced, making possible continued high production with minimum spoilage of work.

Driving torque is absorbed by the balanced impact mechanism permitting finger-tip operation and control. This new screwdriver is known as the Cleco A-1.

Cleco Div., Reed Roller Bit Co., P.O. Box 2119, Houston 1, Texas



Heat Exchangers Introduced For Electroplating Solutions

Design and construction of heat exchangers permit use of same unit for both heating and cooling electroplating solutions as operating conditions require. Units use pure nickel tubes for nickel solutions, steel and special alloy tubes for other applications.

Exchanger can be furnished with a combination of from one to six tubes. Special units are available for unusual capacity or space requirements. Machines are available complete with pump and stand for setting on floor. Tubes alone can be had separately for wall or ceiling mounting.

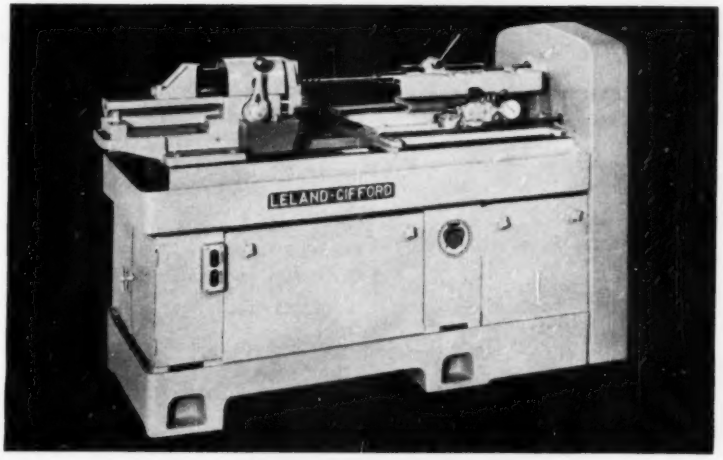
Industrial Filter & Pump Mfg. Co., 1621-39 West Carroll Avenue, Chicago 12, Illinois

THE LELAND-GIFFORD WAY *Is The Best Way To*

DRILL DEEP HOLES

QUICKLY • ACCURATELY • SAFELY

- INFINITELY ADJUSTABLE FEED RATE
- STEP BY STEP HYDRAULIC FEED
- USE STANDARD DRILLS
- NO WORK ROTATION
- RAPID APPROACH
- QUICK RETRACTION
- CLEARS THE CHIPS
- FLOOD COOLING
- OVERLOAD PROTECTION
- DRILLS STRAIGHTER HOLES
- REDUCES TOOL WEAR
- PREVENTS DRILLING BREAKAGE
- AUTOMATIC STOP AT PRE-SET DEPTH
- RETURNS AND RESETS



LELAND-GIFFORD HYDRAULIC FEED DRILLING MACHINES

To drill deep holes with maximum speed and precision, without costly drill breakage and with minimum drill wear and replacement the drill must be withdrawn from the work at frequent intervals to:

(1) CLEAR THE CHIPS **(2) COOL THE CUTTING EDGE**

The only safe, sure way to do this is with the patented Leland-Gifford *Step by Step* Hydraulic Feed which automatically retracts the drill at *definite, predetermined* steps . . . before the drill point can reach a critical temperature and before the flutes clog with chips.

The Leland-Gifford *Step by Step* Hydraulic Feed can be furnished for horizontal drilling as illustrated by the Single Spindle, Self-Contained, Horizontal Deep Hole Drilling Machine shown above, or for vertical or angular drilling . . . in steps and total traverses to meet your requirements.

If you drill holes more than 4 diameters deep, it will pay you to check with Leland-Gifford. Write for complete information.

PRODUCTION MEN

Get This Handy Slide Rule. A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

- CHICAGO 6, ILL. 565 W. Washington Blvd.
- DETROIT 26, MICH. 1533 Dime Bank Bldg.
- CLEVELAND 1, OHIO P. O. Box 5547
- NEWARK 2, N. J. Industrial Office Bldg.
- ROCHESTER 1, N.Y. Commerce Bldg.
- LOS ANGELES 14, CAL. 724 South Spring Street

2000-lb Capacity Pallet Truck Handles Corrugated-Paper Pallets

Expendable 4-way corrugated-paper pallets having large cylindrical supporting columns can now be handled by a newly designed hand pallet truck.

Capacity of this new truck is 2000 lb. It has a lowered height of 3¼ in. and an elevated height of 7¼ in. Truck will also operate in the standard double-faced wooden pallet.

Lyon Richmond Corp., 2441 Madison St., Greene, N.Y.

Self-Adhesive Marker Applied to Wire End, Terminal

Identification of terminals, harness boards, switches and panels is said to be improved with Spot-It, a self-adhesive marker applied to any wire end or terminal. Spot-It markers are in black and white.

Only one number or letter designation appears per marker. Each marker measures ⅜ in. sq, for ease of visibility. Markers are numbered from 1 to 10 and also lettered from A to Z.

Western Lithograph Co., 220 Rose St., Los Angeles 54, Calif.

Solenoid-Operated Valve Automatically Oils Bearings

Individual bearings to be lubricated are oiled from a reservoir by a solenoid-operated valve. Process is automatic, and feeds to bearings are either single or multiple sight.

Solenoid is connected across line of driving motor. Upon starting motor, lubrication of bearings begins immediately. The single reservoir feeds up to 24 bearings.

Line adjustments on each feed valve can be made and retained through the use of a friction screw. Adjustment can be retained and protected against severe vibration by locking the adjusting screw. In case of power failure, oiler can be operated manually.

Oil-Rite Corp., 3486 South 13th St., Milwaukee 7, Wis.

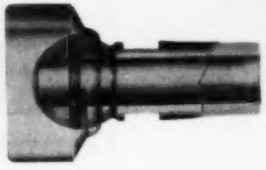
Small-Hole Gages, Pin Vises

Small-hole gages measure diameters of holes or the width of slots or grooves below the 5/16-in. range.

Size of the ball end is adjusted by turning the knurled knob at opposite end of gage. Radius of ball end is always less than that of hole being measured, making only a 2 point contact. Ranges available are ⅛ to 3/16, 3/16 to ¼, ¼ to ⅜, and ⅜ to ½ in.

Vises are also offered for holding small stock to be worked, taps, drills, scribers and small files. Hole runs entire length of handle, accommodating stock up to the full stated capacity of the vise. Knurling at convenient locations allows good grip. Capacities available are: 0 to 0.055 in.; 0.025 to 0.075 in.; 0.045 to 0.135 in.; and 0.110 to 0.200 in.

The Lufkin Rule Co., Saginaw, Mich.



Water Hole Drilled Completely Through Shank of Electrode

Improved swivel-type resistance welding electrodes have water hole drilled completely through the shank. Thus cool water is brought directly in contact with swivel head. Test indicates a stabilized operating temperature of 94C for the new unit, compared with 332C for earlier designs. This reduction materially increases the life of the swivel tip.

P. R. Mallory & Co. Inc., Indianapolis, Ind.

DressOmeter Diamond Actuator Rotates Tool Automatically

Cumbersome practice of rotating diamond tools by hand is eliminated by this automatic diamond actuator.

Compression of a plunger against the end guard of a grinding machine rotates diamond automatically 22½° on each complete pass across the wheelface. This assures the most effective cutting surfaces on 16 facets. Product called DressOmeter diamond actuator, has been tested on all types of grinding machines, and is inclosed in a dust-proof housing.

J. K. Smit & Sons, Detroit, Mich.

German Caliper Again Available

Precision calipers imported from Germany are again available to American craftsmen. These instruments, until today, have been unobtainable in quantities.

The Glogau vernier caliper No. 12 is made of hardened German steel and nickel-plated. Full measuring capacity is 5 in., and 120 mm. Graduations on bar are 1/16 in. and 1 mm. Vernier readings of 1/28 in., and 1/10 mm. are obtainable. A stop arrangement is available for permanent settings.

Glogau & Co. Inc., Dept. O, 1910 W. Birchwood Ave., Chicago 26, Ill.

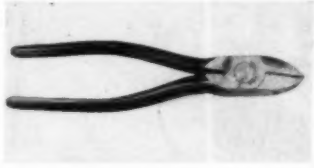
Filter Cloth By Roebling Made from Hastelloy Wire

Resistance to severe chemical corrosion is a main feature of this wire filter cloth made of Hastelloy.

Hastelloy alloys are high-strength, nickel-base alloys that withstand action of nearly all acids, over a wide range of temperatures and concentrations. They are also resistant to such oxidizing agents as ferric chloride and wet chlorine.

Filter cloth is made of two different grades. One is Alloy B which contains nickel, molybdenum and iron. The other, Alloy C is made of nickel, molybdenum, chromium and iron.

John A. Roebling's Sons Co., Woven Wire Fabrics Div., Trenton 2, N.J.



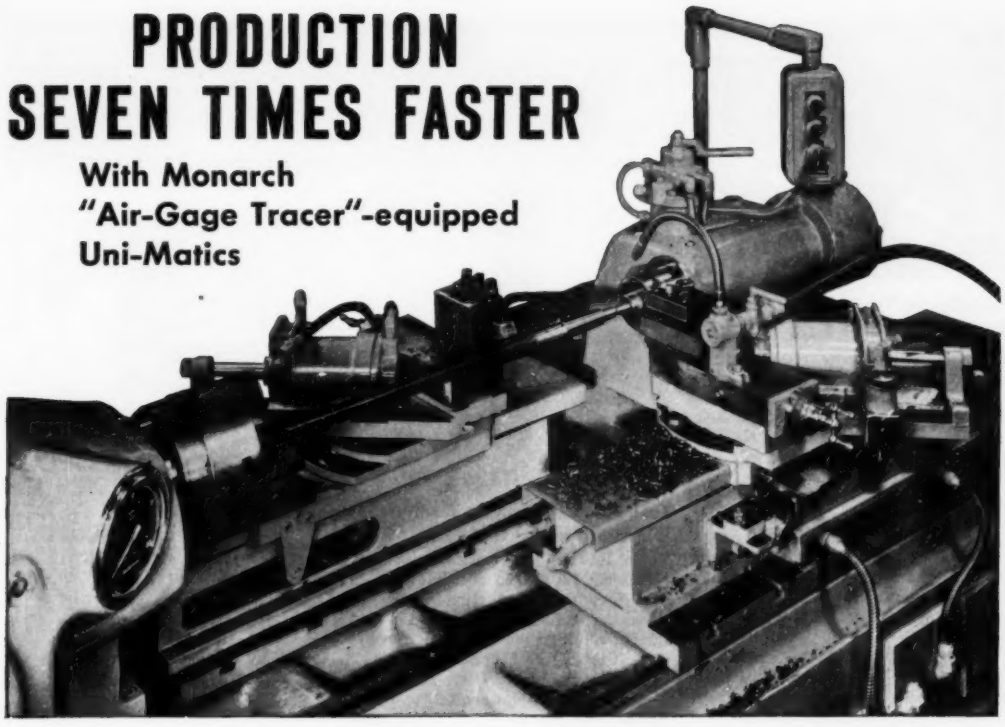
Diagonal-Cutting Pliers

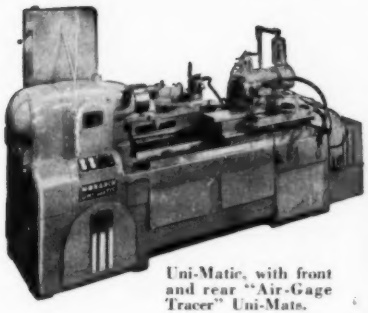
Diagonal-cutting pliers in 6- and 7-in. sizes are drop forged from a special high-carbon steel. Jaws are hardened, tempered and then receive a second hardening by electronically controlled heat-treatment.

J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N.Y.

PRODUCTION SEVEN TIMES FASTER

With Monarch "Air-Gage Tracer"-equipped Uni-Matics





Uni-Matic, with front and rear "Air-Gage Tracer" Uni-Mats.

One operator, tending two Monarch Uni-Matics, "Air-Gage Tracer"-equipped, turns out these axles in a floor-to-floor time of 1¼ minutes. In the installation obsoleted by the Uni-Matics, the same operator had to tend *four* multiple tool automatics—and the floor-to-floor time was 4½ minutes per shaft. That's a per-machine production rate 7.2 times faster for the Uni-Matics!

But speed—and lower machine investment—are not the only advantages of this installation. Accuracy is greater, too. Run-out is held to half as much on the Uni-Matics—and by leaving less grind stock, grinding time is reduced. The simple, single-point tooling of Air-Gage Tracing means shorter setup time, fewer adjustments, lower tooling costs.

This exclusive Monarch machining method, tracing directly from a template, is equally applicable to all types of contour turning, boring and facing, including step shafts—in large lots or small. May we show you how it can bring "peak production at a profit" to your shop?

Front Uni-Mat Template, first machine.

Rear Uni-Mat Template, first machine.

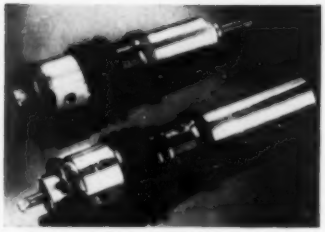
Uni-Mat Template, second machine.

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY • Sidney, Ohio

FOR A GOOD TURN *FASTER*—TURN TO MONARCH



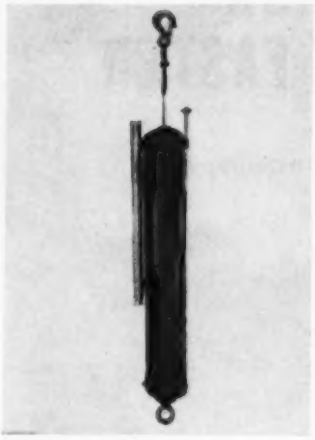
Auto-Recess Toolholder Available in Three Sizes

Designed to perform automatic recessing operations on high-speed automatic machines, this Auto-Recess toolholder can be attached quickly and easily to automatic machine toolholders. Adjustment for recess location and diameter are made on the tool itself.

Tool employs a segmented-type gear mechanism, designed to reduce ratio of cutter feed into the work, taking into consideration regular cam feed for drills. This ratio can be varied to permit changing from one job to another.

Tools are available in three sizes of 1½, 2, and 3, and tool sizes indicate the size of slide toolholder on the automatic machine that the tool shank will fit. Holders No. 1½ and No. 2 handle to 2- and 3-in. ID, respectively. No. 3 tool has a capacity for cutting recesses up to 4-in. ID max. Auto-Recess tools can be furnished with either ball-bearing pilot operation or drawbar actuation.

The Maxwell Co., Bedford, Ohio



Tool Balancer Handles Weights from 10 to 500 lb

Tools left in any position in the balancing range are accurately balanced by this production tool balancer. Instrument eliminates any up or down creep, and can be moved with the slightest pressure.

Balancer hangs from a fixed point, or can be equipped to operate on a standard 4-, or 6-in. I-beam, Cleveland Tram-rail, or American Monorail as desired. It swivels vertically from 0 to 17° and will rotate 360°. Safety latch holds tool at top of balancing range when production line is down for the day or air is shut off.

Unit, manufactured in balancing ranges of 36 and 42 in., handles tools that weigh from 10 to 500 lb. It operates on 100-lb air-line pressure.

An adjustable-weight tool balancer is also available.

The Platz Co., 20433 Sherwood Ave., Detroit 12, Mich.

Recirculating Pump Handles 7 2/3 gpm Against 2-ft. Head

This recirculating pump handles 7 2/3 gpm against a 2-ft. head, or 2 2/3 gpm against a 10-ft. head. Pump is powered by specially designed 1/35-hp motor operating on 115-v ac, 60 cycles, 80 watts at 3100 rpm.

Pump is recommended for evaporative coolers, coolants for machine tools, welders' tanks, laboratory and experimental work, and other applications.

Thermador Electrical Mfg. Co., Los Angeles 22, Calif.

GE Permafil Seals Porous Metal Castings

Shorter baking time, good core permeability, and collapsibility are provided by a new liquid resin for sealing porous light-metal castings.

The material called G-E Permafil permits salvage of castings which would otherwise be rejected because of porosity. It also allows use of castings in applications involving oil or vapor pressures.

This new material, a polyester-type resin, converts to a tough, clear, solid, free of voids, through the action of catalysts and heat. Vacuum impregnation and subsequent short oven bake seals the castings.

Chemical Dept., General Electric Co., Pittsfield, Mass.

STRADDLE-TRUCK EXTENSION SHOES increase possible length of palletized loads while eliminating necessity of special large skids or platforms. Extension shoes bolt to regular gripping shoes of trucks. With adapter shoes installed on a Hyster MH straddle truck, 40 filled drums weighing approximately 10 tons can be picked up and transported in a single trip—*Hyster Co., Portland 8, Oregon*

This is a typical list of manufacturers who, since the end of the war, have purchased Sunbeam STEWART FURNACES to help reduce costs and keep themselves competitive

A Abroff Mfg. Corp.
Acker & Man, Inc.
Adams Construction Co.
Addressograph-Multigraph
Advertising Metal Display
All-Steel Equip. Co.
Allbright-Nell Co.
Allen Bradley Co.
Allen Mfg. Co.
Allis-Chalmers Mfg. Co.
Altorfer Bros. Co.
Aluminum Co. of America
American Air-Filter Co. Inc.
American Airlines Inc.
American Ball Bearing Corp.
American Brake Shoe Co.
American Brush Corp.
American Can Co.
American Cast Iron Pipe Co.
American Chain & Cable Co. Inc.
American Electric Fusion Corp.
American Hardware
Corbin Cabinet Lock Div.
American Hollow Boring Co.
American Instrument Co., Inc.
American Meter Co., Inc.
American Optical Co.
American Phenolic Corp.
Anderson-Carlson Mfg. Co
Anderson Co.
O. L. Anderson Co., Inc.
Apex Smelting Co.
Armstrong Cork Co.
Art-Craft Optical Co., Inc.
Atchison, Topeka & Santa Fe Ry. Co.
Auto Spec. Mfg. Co.
Automatic Electric Co.
Automatic Gas Co. of Columbus, Inc.

B Badger Tool & Eng. Co.
B. A. Ballon & Co., Inc.
The Bassick Co.
C. J. Bates & Sons
Bauer & Black Div., Kendall Co.
Bayuk Cigars, Inc.
Beatrice Steel Tank Mfg. Co.
Bell & Gossett Co.
Bell & Howell Co.
Belle City Mfg. Co. Inc.
Bendix Aviation Corp.
L. A. Benson Co. Inc.
Bernardin Bottle Cap Co. Inc.
Blizzard Mfg. Co.
Blue Ridge Pressure Castings
Bolens Products Co.
Bonney Forge Tool Works
Boston Wire Stitcher Co.
James H. Boye Mfg. Co.
Brasco Mfg. Co.
Chas. D. Briddell, Inc.
Bristol Co.
Broderick Co.
D. S. Brown Co.
Bucyrus-Erie Co.
Edw. G. Budd Co.
Buick Oldsmobile Pontiac Assembly Div., General Motors Corp.
Burgess-Norton Mfg. Co.
Burndy Eng. Co. Inc.

C Caine Steel Co.
Cameron Mfg. Corp.
Carbo Tool & Die Co.
Carnegie-Illinois Steel Corp.
Certain-Teed Prod. Corp.
W. M. Chace Co.
Chain Belt Co.
Chamberlain Corp.
Cherry-Burrell Corp.
Chicago Auto Spring Co.
Chicago & North Western Ry. Co.
Chicago Pneumatic Tool Co.
Chicago Rawhide Mfg. Co.
Chicago, Rock Island & Pacific RR Co.
Chicago Screw Co.
Chicago, South Shore & South Bend RR
Chopie Tool & Die Co.
Chrysler Corp.
W. M. Cissell Mfg. Co.
Clayson-Forenz Co.
Clifton Conduit Co.
Colgate Mfg. Corp.
Collyer Insulated Wire Co., Inc.
Corn Products Refining Co.
Cummins Business Machines
Cutler-Hammer, Inc.

D Davis & Furber Mach. Co.
Day Brite Lighting, Inc.
Deere & Co.
Detroit Gear Div., Borg-Warner Corp.
Detroit Stamping Co.
Diamond Expansion Bolt Co., Inc.
Doehler-Jarvis Corp.
Dole Valve Co.
E. I. DuPont de Nemours & Co., Inc.
Dynamatic Corp.

E Eagle Pencil Co. Inc.
Eastman Machine Co.
Eclipse Sleep Products, Inc.
Ehlert Tool Eng. Co.
Electric Storage Battery Co.
Emerson Electric Mfg. Co.
Essex Wire Corp.
Chicago Transformer Div.
R-B-M Div.
Eveready Tool Co.
Eversharp, Inc.

F Fafnir Bearing Co.
Ferraro Spring & Parts Co., Inc.
Fischer & Porter Co.
Michael Flynn Mfg. Co.
Foreman Mfg. Co.
Frazer & Jones Co.

G General Cable Corp.
General Electric Co.
General Motors Corp.
Electro-Motive Div.,
Frigidaire Div.
General Tool & Die Corp.
Gerotor May Corp.
Gibson Refrigerator Co.
Girard Mfg. Co.
Gisholt Machine Co.
Great Lakes Spring Corp.
Green Bay Drop Forge Co.

H Hammond Brass Works
Harrington & King Perforating Co.
Hartford Machine Screw Co.
J. F. Helmhold & Bro.
Hi Level Screw Prod. Co.
High Speed Hammer Co. Inc.
Hotpoint, Inc.
Houdaille-Hershey Corp.
General Spring Bumper Div.
Huntington Div.
Oakes North Chicago Div.
M. D. Hubbard Spring Co.
B. H. Hubbert & Son, Inc.
Hummer Mfg. Co.
Hy-Pro Tool Co., Inc.
Hydraulic Press Mfg. Co.

I- Illinois Tool Works
J International Projector Corp.
International Tool & Gauge Co.
James Mfg. Co.
Johnston Lawn Mower Corp.
Jones & Laughlin Steel Corp.
A. D. Joslin Mfg. Co.

K Kent Galvanizing Co.
Kewanee Mach. & Conveyor Co.
Klein Mfg. Co.
Kraeuter & Co., Inc.
Kropp Forge Co.

L L-S Mfg. Co.
A. Lakin & Sons
Landis Machine Co.
Leach Co.
Ledkote Products Co.
Leman Machine Co.
Line Material Co.
Link Belt Co.
Lloyd Mfg. Co.
Lobdell-Emery Mfg. Co.
Locke Insulator Corp.
Louden Machinery Co.
Lux Clock Mfg. Co.

M Macey Co., Div. Earle S. Irwin Co.
Magnetics, Inc.
Malleable Industries
Manganese Steel Forge Co. Inc.
Manufacturers Machine & Tool Co.
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Modine Mfg. Co.
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Massberg Pressed Steel Corp.
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N Nachman Corp.
Nash-Kelvinator Corp.
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National Rivet & Mfg. Co.
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Northwest Metal Prod. Inc.

O- Ohio Brass Co.
Oliver Corp.
P Pacific States C. I. Pipe Co.
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R Radio Corp. of America
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Timken Roller Bearing Co.
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Townsend Co.
Triangle Auto Spring Corp.
Triplett Electrical Instrument Co.
Tube Turns, Inc.

U- U. S. Cloth Cutting Mach. Co.
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V United-Carr Fastener Corp.
Universal Chain Co. Inc.
Universal Oil-Seal Co.
Ushco Mfg. Co., Inc.
Vince Forging & Mfg. Co.
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W Waterloo, Cedar Falls & Northern RR
Watson Elevator Co. Inc.
Waukesha Motor Co.
Weaver Mfg. Co.
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Western Electric Co., Inc.
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Woodring & Wise Machine Shop

Y- Yale & Towne Mfg. Co.
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A DIVISION OF Sunbeam CORPORATION

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A letter, wire or 'phone call will promptly bring you information and details on SUNBEAM STEWART furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a SUNBEAM STEWART engineer will be glad to call and discuss your heat treating problems with you.

Mail this coupon for complete information on furnaces to meet your needs:

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- ☐ Gas nitriding
- ☐ High speed steel
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- ☐ Oven
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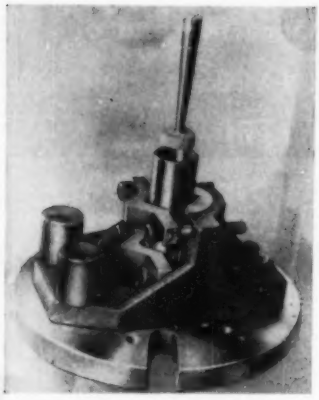
- ☐ Recirculating
- ☐ Rivet heaters
- ☐ Rotary hearth forge
- ☐ Soldering iron heaters
- ☐ Tempering
- ☐ Tool hardening

Name _____ Title _____
Company _____
Address _____



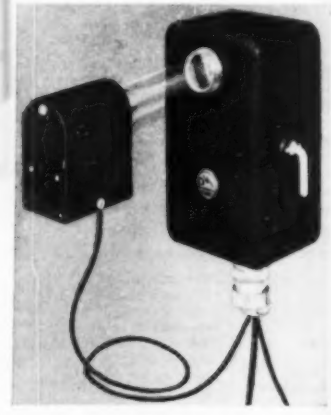
Workholder for Lathes, Grinders Handles Work to Close Tolerances

Quick accurate setups on lathes, grinders, jig borers, milling machines and drillpresses are provided with this workholder.

Holders are made of fine quality close-grained cast iron. Clamps are case hardened with slots so they may be reversed without removing screws. Counter-balancing weights have eccentric holes.

Work can be held to tolerances of 0.0002 in 3 in. It was developed for the manufacturer's own toolroom, but has been found to be practical in many other uses. Holder is 7 x 4½ x 3 in.

Lassy Tool Co., 96 Bohemia St., Plainville, Conn.

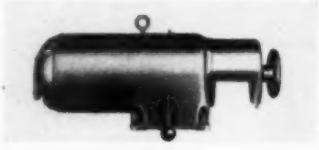


Photoelectric Control Prevents Jamming on Conveyor Lines

Jamming of cases or cartons on conveyor lines is prevented by the recently developed Photoswitch delayed-action photoelectric control. It has been designed to indicate presence of a jam and to introduce conveyor stop motion or other correction.

Control and light source are placed on opposite sides of the conveyor so that a case passing along conveyor will interrupt light beam. Relay action in the control occurs only when the light beam has been interrupted for a predetermined time interval, representing a longer period than would be normally required. Excessive light beam interruption can be caused only by the jamming of several adjacent cases. Interval is adjustable from ½ sec. to 5 sec.

Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass.

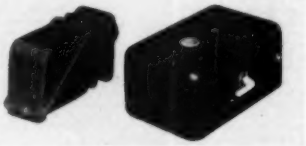


Selective-Speed Gearshift Drive Incorporates 4-Speed Transmission

Machine tools formerly driven from a line shaft can now be individually motorized by this selective-speed gearshift.

Gearshift drive has three gear ratios as follows: low, 4 to 1; second, 2 to 1; third, 1.33 to 1; high, 1 to 1. Units are built with 4 speeds in ratings of 3 hp at 900 rpm to 10 hp at 1800 rpm, with 8 speeds in ratings of 1 to ½ hp at 1200 to 600 rpm to 5 hp at 1800-900 rpm. All models are instantly reversible in speed by using a motor-reversing control.

The Lima Electric Motor Co., Dept. AA 91, Lima, Ohio

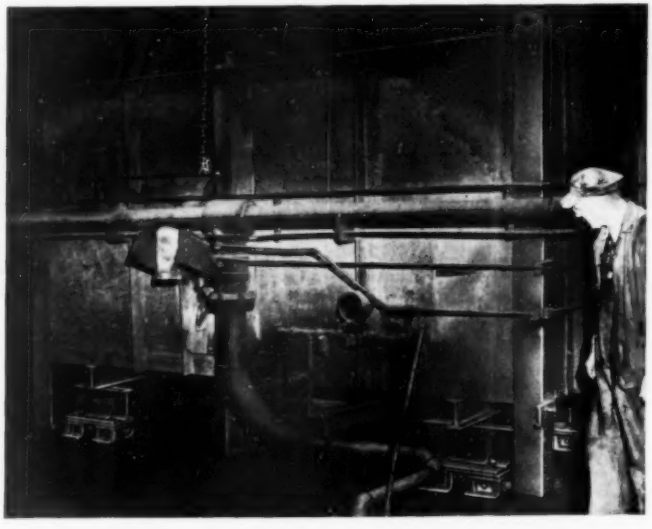


Instrument Safeguards Oil Burner From Flame Failure

Protection of oil burners from the dangers of flame failure and automatic programming for these burners is offered in a new control instrument. Set includes photoelectric scanner and a programming control.

The photoelectric system continuously monitors the oil flame and, when flame fails, instantly signals the programming control. Programming control automatically starts the burner in operation and programs a sequence of fuel valve opening, post ignition time, priming, and scavenging.

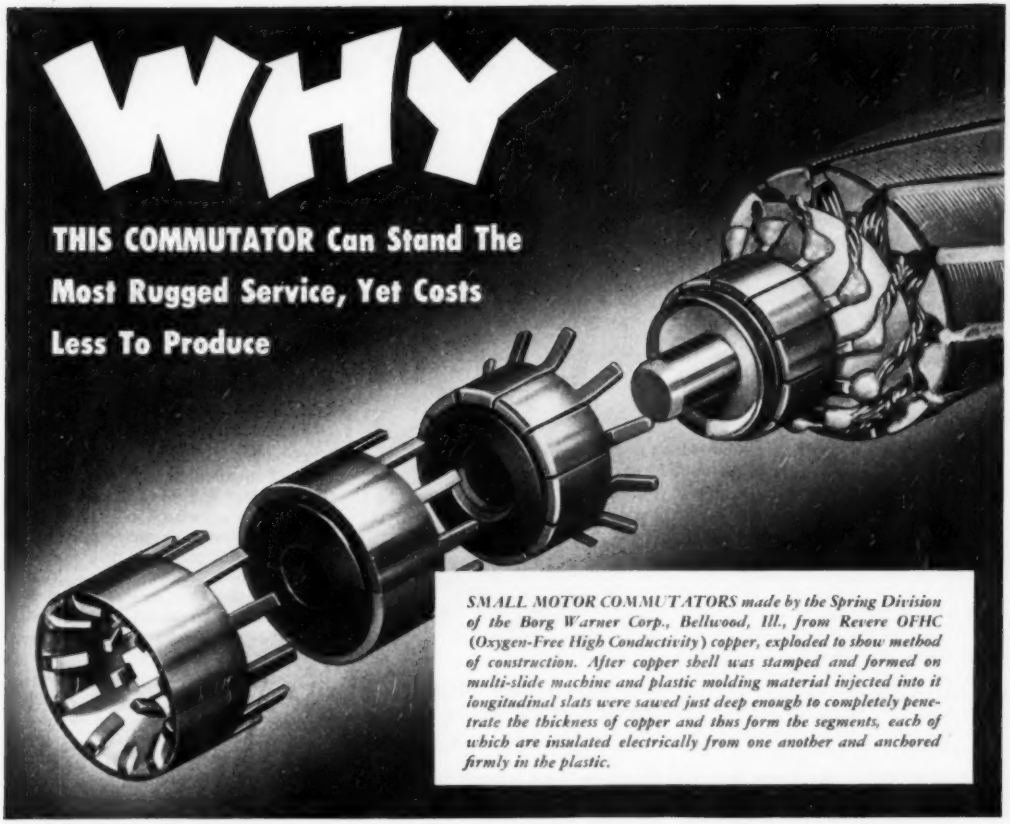
Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.



MOUNTING on coil-spring Vibroisolators eliminates replacement of brick for this 20-ton furnace. Reports indicate that life of arch and top have been increased nearly 2½ times—*Korfund Co., Inc., 48-15 — 32nd Place, Long Island City 1, N.Y.*

WHY

THIS COMMUTATOR Can Stand The Most Rugged Service, Yet Costs Less To Produce



SMALL MOTOR COMMUTATORS made by the Spring Division of the Borg Warner Corp., Bellwood, Ill., from Revere OFHC (Oxygen-Free High Conductivity) copper, exploded to show method of construction. After copper shell was stamped and formed on multi-slide machine and plastic molding material injected into it longitudinal slats were sawed just deep enough to completely penetrate the thickness of copper and thus form the segments, each of which are insulated electrically from one another and anchored firmly in the plastic.

IT was quite a complex problem the Spring Division of Borg Warner Corp. dropped into the lap of Revere's Technical Advisory Service. They were getting set to manufacture commutators for small motors and they wanted to select the best material for the job.

Here were the specifications: The material had to be the hardest possible yet still able to take the extremely severe forming operation which was to be done in a multi-slide machine. High hardness was necessary in order to combine maximum wear resistance with the ability to withstand the extreme centrifugal force developed in small motors operating at high speeds. In addition, in the molding operation, which is done after the copper shells have been formed, it was necessary to hold the diameter of the shell to within .001" in order to prevent the plastic from flowing between the mold and the outer surfaces of the commutator. An equal tolerance was also imposed upon the height of the solid cylindrical portion for the same reason. Also of great importance was the need for the cylinder wall being almost absolutely flat.

Because of long experience with somewhat similar problems Revere recommended trial of OFHC (Oxygen-Free High Conductivity) copper, four numbers hard. This was tested along with several other metals. The OFHC alone was found to produce excellent parts, and with tolerances so close as to be almost unbelievable in this type of operation. All other types of copper failed at the very sharp bend where the anchoring lugs join the side of the shell.

An unusual feature of these commutators is the plastic material used in the core. Tough, and unusual in composition, it serves both as insulation and as a mechanical connection between commutator and shaft without use of a bushing and key.

To determine if these commutators could *really* take it, test motors in which they were used were speeded up to 35,000 rpm. Although the wiring in the rotors practically exploded at that speed, there were no failures in the commutators, Temperature tests up to 400° F. were also made. Here again there was no damage to the commutator, though the rotor wiring was badly damaged due to the combination of centrifugal force and decrease in wire strength. Once again the unusual combination of properties of Revere OFHC copper had played a part in helping another one of the country's leading manufacturers produce an outstanding product at less cost.

Perhaps this or some other Revere Metal can be of help in improving your product—cutting your production costs. Toward that end we suggest that you get in touch with your nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

Hydraulic Crane Scale Measures Loads Being Handled

This hydraulic scale is primarily designed for measurement of loads as they are handled by a crane. It is also easily adapted for other force and/or load measuring applications.

Basic feature of scale is the Type EU Emery hydraulic cell, the same in principle as the cell used on Baldwin-Tate-Emery testing machines. Cell converts force into corresponding fluid pressure which is connected to an indicator calibrated to read in pounds of load on the scale.

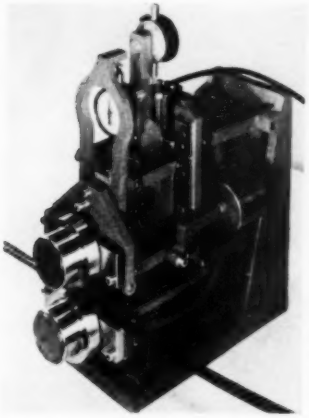
Scale measures from approximately 22 to 36 in. in over-all height, depending on model. Hook and eyebolt are swivel mounted. Three dial sizes are available, with 8½-, 12-, or 16-in. dia.

The A. H. Emery Company, Stamford, Conn.

Compact Toggle Clamp Has Retractable Clamping Bar

Clamping bar of this compact toggle clamp moves into a retracted, vertical position away from work as clamp is opened. Advantages include: reamed working surfaces, stainless-steel bearings, rugged construction and smooth, fast, powerful clamping action. Clamp comes equipped with rubber-tipped bolt assembly adjustable both horizontally and to work height. Size is 1⅞ in. high by 6½ in. long when bar is in horizontal workholding position.

Detroit Stamping Co., Finished Products Div., 343 Midland Ave., Detroit 3, Mich.



Gage Measures and Controls Thickness of Coating on Wire

Thickness of plastic coatings deposited on copper electrical wire is accurately and automatically controlled with this continuous measuring gage.

The Federal Electricator transmits electrical impulses when dimensions are out of tolerance. Machine is thus controlled automatically and a uniform coating thickness is maintained. If desired, a continuous thickness recorder can be installed providing supervision with the continuous record of machine fluctuations. Gages are available for glass tubing, metal rods, strip material, and other continuously produced material.

Federal Products Corporation, 1144 Eddy St., Providence, R.I.

New Shapes in Carbide Cutters

M. A. Ford line of carbide cutters has been increased to over 40 standard shapes. These cutters may be used for filing, burring, grinding, finishing, countersinking, chamfering, light milling, profiling and tool, die and mold machining. Carbide cutters are said to outlast high-speed steel files and cutters 100 times.

The M. A. Ford Mfg. Co., Inc., Davenport, Ohio

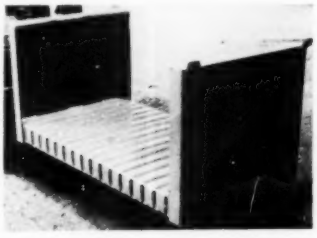
Small Screws in Stick Form Can Be Fed with Varied Drivers

Used in pneumatic, electric, spiral or hand-rachet drivers, a one-piece stick of identical screws makes fastening faster and simpler.

Screws are twisted off automatically and fastening made when a predetermined torque is reached. As the tightened screw is freed from the neck, the next screw in line is automatically advanced. Amount of torque is controlled by cross-sectional area of neck joining the screws. Head of driven screw is burnished smooth by the next screw to be driven.

Screwsticks are available in No. 0, 1, 2, 3, 4, and 5 diameters, in mild steel, brass and aluminum.

American Screw Co., Providence 1, R.I.



Unit Combines Advantages of Pallet and Rack

Best features of both pallet and rack are combined in a new open-side pallet-rack. The unit can be used to tier unit loads of odd shapes and sizes, which could not be safely handled and stored with pallets or racks. Open sides make materials easily accessible. Pallet-rack is available for both heavy and light loads. When tiered 4 high, the pallet-rack easily accommodates stacked loading exceeding 24,000 lb.

Union Metal Mfg. Co., Canton, Ohio

SCHERR *aids to precision – production*

- OPTICAL COMPARATORS
- TOOLMAKER MICROSCOPES
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- COMPARATOR GAGES
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- "MAGNE-BLOX" for magnetic-chucks

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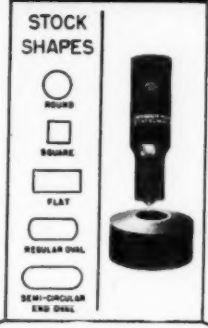
GEO. SCHERR CO., Inc.

PUNCHES and DIES

STOCK SHAPES



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WESPO MOUNTING BOLTS

BOLSTER and T-SLOT TYPES

Valuable Dies and Bolster Plates are No Better nor Safer than their Mounting Bolts

Standards of vital importance in press room operation, recently adopted by the Joint Industry Conference of American Manufacturers, included specifications covering Bolster, Mounting and T-Slot Bolts. Bolts to J.I.C. specifications are now available from WESPO.

WESPO BOLT FACTS

Wespo T-Bolts are forged, machined and heat treated to necessary specifications and more than meet the tensile strength required.

NUTS and WASHERS

NUTS—hardened—threaded to close fit. WASHERS—hardened—ground on both sides.

BOLT SIZES

BOLSTER BOLTS—up to 1½ dia. Heads, square to 3" or hex to 2¾". T-SLOT BOLTS —½, ⅝, ¾ lengths to 12". 1" bolts 4" to 22".

Write for bulletin and prices.

WESPO also makes fixture clamp assemblies and over 350 fixture parts. Write for bulletin and prices.

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WESPO A BETTER BOLT AT A LOWER COST

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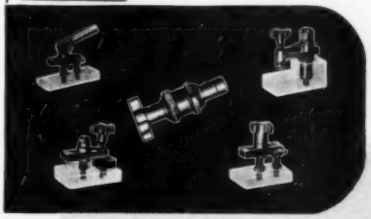

BE DOUBLY SURE with M-T QUALITY

FIXTURE CLAMPS—wide range of sizes and types to fit every requirement.

JACK LOCKS . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

Write for Complete Catalog.

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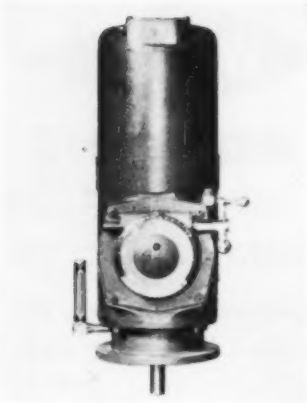


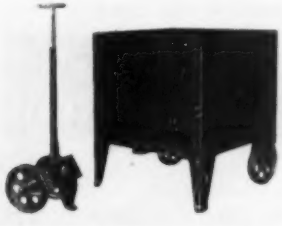
Variable-Speed Transmission For Vertical Flange Mounting

Designed for vertical flange mounting, a variable-speed transmission offers speeds from 1100 rpm to zero. It is available in sizes from ¼ to 1 hp.

The unit has standard NEMA flange-mounting dimensions and can be furnished with special shaft extension where required. Construction features spaced bearings on the output shaft with two tandem-mounted oil seals.

Micrometer control makes possible accurate speed settings. Transmission is said to closely maintain its set speed even with change in load and is suitable for metering.

Graham Transmissions Inc., 3754 North Holton St., Milwaukee 12, Wis.



Scrap Truck Designed to Work With Fork Lifts

Usefulness of the revolving-head fork truck is increased by this new scrap truck, part of the Turner System of materials handling.

Fork truck can pick up the unit from either front or back, and can move it anywhere. With truck forks engaged in the channels, scrap truck can be turned to any desired angle or upside down. These bin trucks can be converted to maneuverable hand trucks with use of the Turner hand Jimmy. Thus, operator can position the load at his convenience, without use of a power truck.

The scrap truck is available with steel sides 20, 24, 28, 32, and 36 in. high, with the corresponding capacity up to 22 cu ft.

Factory Service Company, Milwaukee 9, Wis.

Test Head for Metals Comparator Works on Flat Surfaces

More extensive application is provided for GE metals comparators by addition of this comparator test head. Head was developed for use where the test coil is not applicable. Composition, heat-treatment or hardness can be closely controlled.

The electronic unit includes a balancing network, oscillator, and indicator. It operates on a single-phase, 60-cycle, 110-v supply. Machine has been designed for flat surfaces for use on large specimens such as forgings, machine tool beds, and other parts.

General Electric Co., Schenectady 5, N.Y.

Ellipse Master Templet Handles Axonometric Drawings

Applicable to all axonometric drawing is a newly developed ellipse master templet.

It is claimed that this templet, No. 77, has time-saving features, such as true isometric ellipses, projected from an angle of 35° 16 min., and allowance for pencil point to facilitate accuracy and drafting speed.

Each ellipse is milled from 0.030 mathematical-quality plastic material to engraving machine accuracy. Axes and sizes are indelibly printed on face of templet. Each ellipse degree has perfect concentricity. Templet has standard 3-ring binder holes for notebook use.

Rapidesign, Inc., P.O. Box 592, Glendale, Calif.

Throttle-Controlled Sander Has Speeds to 5000 rpm

Good performance at adjustable speeds is provided in a recently developed lightweight vertical sander.

Machine has an all-magnesium housing. Without sanding pad, weight is 5 lb, height to end of spindle is 8½ in. Speeds up to 5000 rpm can be adjusted by throttle control.

An exhaust deflects and cools the sanding pad during operation. A safety throttle has been designed to eliminate quick starts and stops and reduce tool and pad inertia.

Aro Equipment Corp., Bryan, Ohio

Small Steam Cleaner Has Features of Larger Units

Designed especially to fit the needs of small operators and shops, this Hypressure Jenny steam cleaner requires only 27x37 in. of floor space and develops 80- to 120-psi working pressure. Its normal 45-gal. per hr capacity can be stepped up to 240 gal. per hr by means of an adjustment. All units are oil fired and electric motor driven.

Homestead Valve Mfg. Co., Coraopolis, Pa.

You can't afford
COSTLY TIE-UPS
like this . . . .

when you can
STOP DELAYS . . .

SPOT these Bench Grinders *around your shop* SAVE STEPS . . . SAVE TIME!

It's far more economical to equip your plant with enough Black & Decker 6" Standard Bench Grinders . . . than to have workers waiting in line, trying to make too few Bench Grinders do the job! When you spot these handy Bench Grinders at strategic points, the savings in man-hours alone more than pays their low cost. And you'll speed up tool sharpening . . . "run-of-shop" grinding . . . a whole raft of cleaning jobs!

Black & Decker 6" Standard Bench Grinders are economical to buy . . . economical to use . . . sturdy, well-balanced tools with many practical features you wouldn't expect to find at such a low price. Order these low-cost Bench Grinders from your nearby Black & Decker Distributor today. Call him today and break up those costly, time-wasting grinding "bottlenecks" in your shop! Write for your free copy of our catalog to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Md.

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Picks up roll of paper from horizontal or vertical position and deposits it either way.

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for handling many large, unwieldy items unsuitable for forks or pallets.

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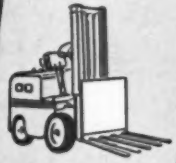
for handling coils or spools of material, castings and many fabricated units.

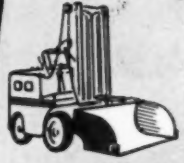
Clamp Lift

for handling boxes or other units that can be gripped securely between the clamping arms.



Brick Fork

for lifting and carrying bricks, concrete blocks and similar products assembled in special patterned units.



SHOVEL

for easy pick-up and dumping of sand, cinders, gravel, coal, aggregate and other bulk material.

These SPECIAL ATTACHMENTS MAKE THE CLARK FORK-LIFT TRUCK *"Many machines in one"*

Inherently versatile, the Clark fork-lift truck, through special attachments to meet specific handling needs, attains far broader usefulness for performing basic materials handling operations. These attachments, easily and quickly interchangeable with the standard forks, equip the machine to handle items varying widely in size, shape and weight—and often without employing conventional pallets. Benefits immediately realized include faster movement of material, increased storage area, greatly reduced accident rates and elimination of some operations.

YOUR Clark dealer is a man worth knowing—competent to appraise your opportunities for savings, equipped to make unbiased recommendations on how to realize them. It's a sound idea to

CONSULT CLARK

Rotating Forks

useful for handling and dumping containers of scrap and other materials.

PUSHER

a most useful device for pushing loads of certain types from the forks.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 3, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

ROUND TABLE *Discussion*

HARD SENSE OR HARD HEAD?

Under present-day operations, I am surprised that such a problem arises with foremen. Most of them today no longer try to solve their problems, but let the engineers who are supposed to "know it all" do their planning. Frequently they even go to the extent of doing nothing to help solve a problem and use it for an alibi to keep from getting raked over by the boss.

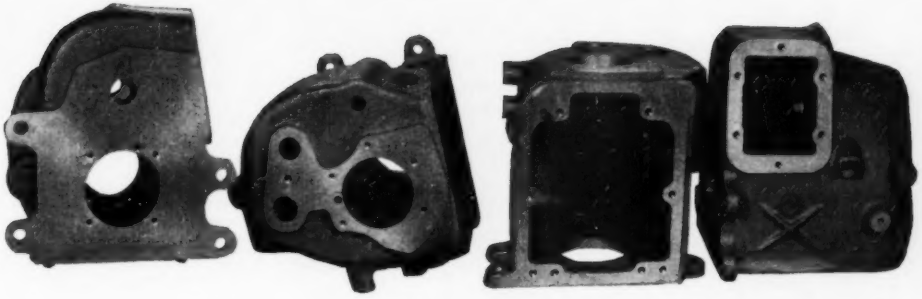
Funny, how the times change. For there were days before the war when this problem was a reality. Maybe those days will again come when foremen realize that part of their work is to help, not hinder, the growth of an organization, to help get the job done in the cheapest possible way. This means cooperation with all others who are likewise trying to accomplish the work in the shortest time.

"Hard-headed" is a good title. How true it is that we like to think we know it all! We all are prone to be like Ed and have pride, and usually it goeth before a fall. The sooner we learn that we can't know all the answers the better off we are. We cannot all have all the practical experience that someone who has worked for years on the problem has collected. Why not use this information? Why not put it to work?

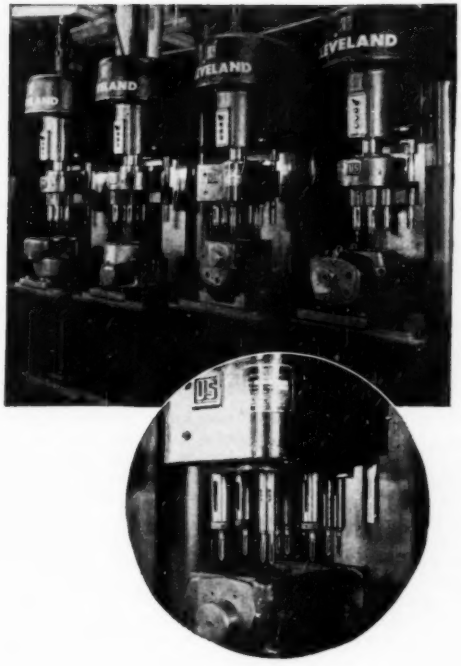
Usually it is because someone is too hard-headed and is not willing to humble himself. He must be a big shot even if it wrecks the company. He thinks his boss, and too often it is true, will be more likely to advance him if he doesn't admit that he doesn't know all the answers. He sometimes thinks that his associates will look down on him, and that he must play the big shot to maintain his prestige and exist.

These conditions are sad but they do exist in far too many companies. Foremen are either too prone to let someone else do their job or they will not let anyone help them as Ed and Al have been doing. Certainly no harm is done if the company has a suggestion system to let the boys in the shop cash in on helping to solve the problems.

Problems are presented if one just goes out to the shop and says "Boys, I'm stuck; can you solve the job for me?" A foreman must be very careful today. He must know his men,



TAPPING PRODUCTION: UP 40%



New Process Gear Corporation, for sixty years a leading manufacturer of automotive transmissions, finds Cleveland Lead Screw Tapping Machines an important aid in cutting production tapping time and costs.

New Process transmission cases, with nine 5/16″-18 and sixteen 3/8″-16 tapped holes in four faces, were formerly tapped on single spindle tappers.

By replacing the single spindle tappers with four Clevelands with multiple heads, each tapping all holes in one face at a single stroke, production was increased 40% with an attendant cost reduction.

In addition, the elimination of much handling with consequent operator fatigue, in combination with Cleveland's fast, automatic cycling, permits the tapping machines to be grouped with drilling and other machines in various production lines with further important economies.

Finally, Cleveland's positive lead-screw feed has greatly improved thread quality, practically eliminated tap breakage and extended tool life an estimated 50%.

On the basis of increased production and economies obtained, New Process is now using eleven standard Cleveland Lead Screw Tapping Machines and two special Cleveland machines on similar operations.

If you have a production tapping job—one hole or a hundred—Cleveland engineers can doubtless find similar opportunities for cost and time savings. Send your prints and parts for study and recommendations or, if you prefer, a competent representative will call to discuss your tapping problems personally. Write, wire or phone The Cleveland Tapping Machine Company, Hartville, Ohio.

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lead screw
tapping machines

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About eight months after the system was installed, Mr. J. A. Klein, Jr., then Superintendent and now President, commented that their McCaskey System had reduced time and clerical work 30%, provided control that was more accurate than the posted records replaced and made available complete monthly analyses approximately two weeks earlier than before.

What was true then is true today, and their requirements have increased in size and complexity. Changes in detail have been made to meet the expanded needs of the organization, but the basic principles of "One-Writing and Visible-Filing" have not been altered.

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for with unions and job-evaluation, trouble is just around the corner for the fellow who asks help from the wrong man. Suddenly the world comes down around the foreman's ears in the form of a gripe. This probably would be along the lines of "the employee wasn't being paid to give advice or information . . . his pay should be raised."

Prior to unionization, the plan Al had would work. It will work today in some companies, those who operate on a plan where the employee is considered as a partner in the business and there is no union except possibly an independent control by the company to some extent.

As previously mentioned, the best way is to develop a suggestion system and pull out the needed help from this system.

One other way the foreman can get help is to go to his engineering department and ask for it. Most of the engineers, and I said engineers—not those who try to show off and call themselves engineers—are always glad to help teach their fellow-workers to do a better job in an easier way.

In answer to one question, should shop employees be considered as "shop help" or should their experience be used, a simple answer is that industry would like to use the men's knowledge but unionism has forced them to abandon the attempt. Industry has failed to teach the worker what he is losing by becoming so tied up in the union.

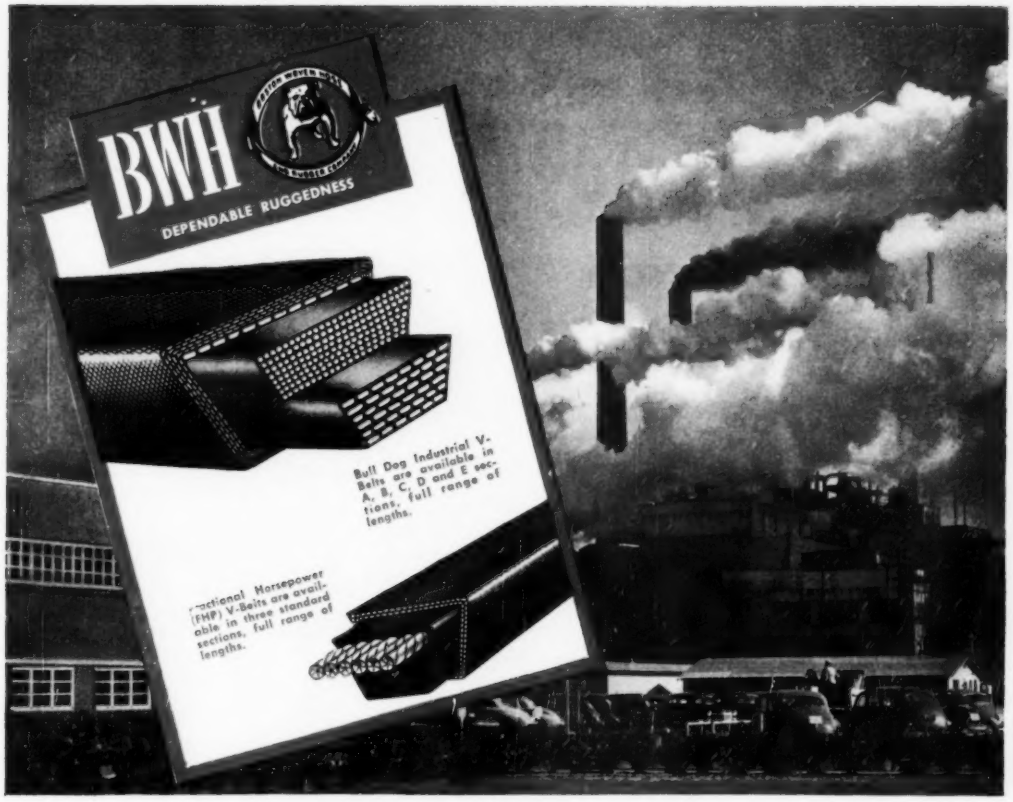
Charles D. Townsend
Centralia, Mo.

•

IS IGNORANCE BLISS?

When a man knows where a part of the machine he is working on belongs, what its function is, he will be more interested in his task than if he regards it as a piece of steel with holes drilled in it. Every man likes to discuss his work with other employees, friends, or relatives, and it is very embarrassing to admit that he doesn't know what he is making. During the war, it was important not to allow the employee to become acquainted with the parts he was making, but there was a good reason for it—in fact, the more secrecy involved, the more important the man felt.

In many plants, the finished product is displayed in each department to acquaint the employees with the individual parts they are manufacturing. In many cases, the employee tries to attain better quality or closer precision so the part he is making will stand out in the unit. This tends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to stimulate competition between the departments to produce a finer product.

Standards can not be changed by the working man if the parts he is making are subject to inspection. If he decides that the part he worked on could be changed for easier assembly or better operation, he will probably tell the foreman or call it to the attention of the design department. Many employees put their ideas in the suggestion box and there is no doubt that some profitable improvements come about.

It is just as important for the foreman to know what he is making or the purpose so that he would know what sections are critical and which are not so exacting. Most of the prints coming from the drafting department are marked "all dimensions ± 1/64" unless marked otherwise." In many cases the piece could be plus or minus ¼ in. and still be acceptable. The engineering department will always insist that the machinist should stick to the print, but in many cases it is not necessary. If the foreman is familiar with the part to be made or its functions, he will instruct his men accordingly. Many times pieces rejected and scrapped because they were not in accord with the print would have served their purpose if actually installed in the final product.

Frank J. Zarnowski
Rutherford, N. J.

•

The importance of workers being fully informed about the product they help make cannot be overemphasized. Full information about the firm's goods promotes industrial efficiency, by cheapening the manufacturing costs and improving worker morale. By increasing the interest in the company and what it makes, a closer approach to the intangible but valuable team spirit is obtained.

It is hard to understand how any work suggestion system can be expected to pay off if all the facts of the matter are not known to everyone. A suggestion for any process improvement is going to be of practical value only if the suggestor is in possession of all the factors that have led to the establishment of the old method that he is trying to improve.

Some firms discourage employees from seeing what is going on in departments to which they are not directly attached. This shortsighted policy is not conducive to improved efficiency, because it is well known that outsiders, bringing a fresh mind and viewpoint to a problem, can make snap suggestions of value that have entirely eluded those who are

broaching will really save you money on those close tolerance high speed internal gears

HERE'S AN ACTUAL CASE:

The Old Production Line-Up	The Way It's Handled Now
1. Rough Broach	1. Rough Broach
2. Shape	2. Finish Broach
3. Shave	
Required Tolerance .0002"	Required Tolerance .0002"

EQUIPMENT USED:

1 Broaching Machine	4 Broaching Machines
18 Gear Shapers	
2 Gear Shaving Machines	

These are actual figures from a well known automotive gear plant which adopted the all-broaching procedure about 2 years ago. Since then savings have been spectacular.

Of course they don't use the garden variety of broaches. The savings and precision achieved would not be possible with ordinary tools.

This plant uses NALOY BROACHES each of which is good for 38,000 gears before it is retired. Naloy broaches have characteristics (and we can prove this) that the average broach shop just doesn't have the facilities to duplicate.

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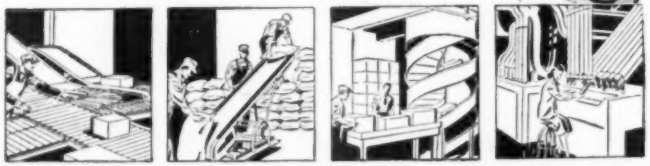


ROLLER - BELT - SLAT - CHAIN CONVEYORS • PORTABLE CONVEYORS AND PILERS • SPIRAL CHUTES • PNEUMATIC TUBE SYSTEMS

in close and continuous touch with the particular puzzle. On the other hand, methods of working observed in other departments can often be applied with benefit to the observer's own job.

Looked at from the psychological viewpoint, worker morale can be greatly boosted by satisfying the possessive instinct. One aspect of the possessive instinct is the desire to be identified with some praiseworthy object, body of people or even an abstract principle or idea. An employee likes to have something to brag about in connection with his work, and given a sufficiency of facts and information about his firm and its product he will pour forth a lot of gratuitous advertising in the course of a casual conversation.

One of the most important factors in reducing excessive labor turnover is that of making employees feel that they are an integral part of the organization, not just hired help. Giving them plenty of information about what they are making, how many are sold in a year, how the product compares with other makers', etc., is all good for developing a desirable team spirit.

Getting down to manufacturing details within the plant, it is my opinion that assembly drawings should be more readily available to those employees who want to see them. Some machinists never see an assembly drawing in years and have no idea what happens to the parts they are turning out. Thus the machinist loses interest in his job because it seems so futile. He cannot appreciate the importance of the bits and pieces he is making because, for all he knows, they might be taken from his machine and dumped on the scrap heap.

Though modern draftsmen are supposed to be infallible and able to show on a detail drawing the most economical standards to which a part should be made, the limitations of the standard drawing do not permit the whole story to be told. The general statement, "Unlimited dimensions $\pm 1/32$" " is responsible for a lot of scrap. Plus or minus $\frac{1}{8}$ in. is good enough in numerous cases and an assembly drawing will prove it beyond doubt.

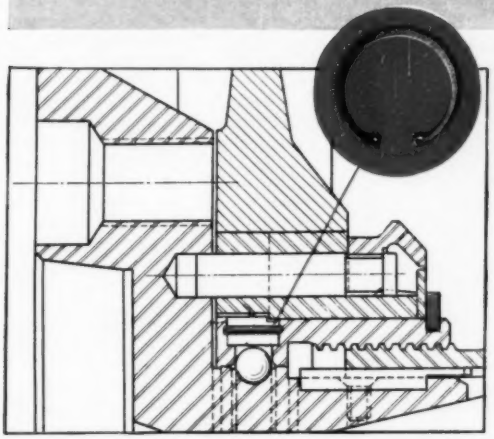
F. E. Riley
London, England

•

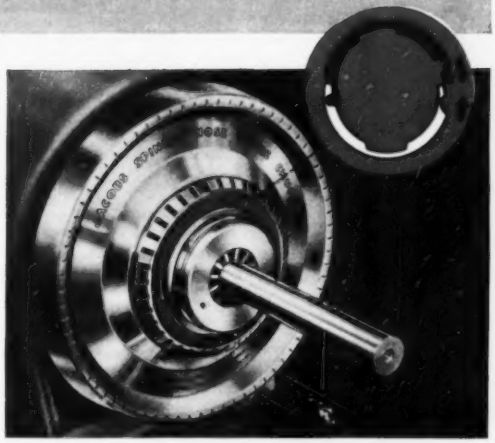
Knowing how and where a part is used is helpful to the one who is making it in many ways.

It arouses the workman's interest when he knows the use the part is put to. He realizes that he is making a part, however simple the part may

2 Waldes Truarc Rings Save Space ...cut costs...Lock entire chuck



INTERNAL RING: Used instead of a shoulder screw, Truarc internal ring #5000-37 locks disc over ball loading hole. Saves 1/8 inch in overall diameter. Eliminates tapping. Withstands machine vibration and vibration from impact device within chuck. Used with Truarc pliers, it facilitates assembly and disassembly.



INTERLOCKING RING: Used instead of a locknut, Truarc interlocking ring #5107-343 locks handwheel assembly securely on impact sleeve of Jacobs chuck. Saves 7/32 inch in overall length. Eliminates tapping. Chuck's top speed: 5000 RPM; Truarc ring is dynamically balanced to withstand 50,000 RPM's. Services easily with a screwdriver.

2 Waldes Truarc Retaining Rings secure the entire mechanism of new spindle nose lathe chuck for Jacobs Mfg. Co., Hartford, Conn. Truarc gives Jacobs a finer, more compact product, and at lower cost than possible with any other fastening device.

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- **Cut overall diameter 1/8 in.**
- **Eliminate cost of tapping**
- **Withstand up to 50,000 RPM's, give a factor of assurance of 10**
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- **Facilitate assembly, disassembly**

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be, that is required on a useful mechanism to make it function properly, thus giving him a feeling that he is not only a capable workman, but also that he is a factor in a group that is meeting the needs of humanity in progressive action.

Certainly an ambitious person would be interested and proud in being one of those whose work was engaged upon parts that are used on a product exhibited in the plant where it was manufactured, so that a study could be made of its functions, leading to possible changes for improvement.

While working drawings are usually made with the necessary tolerances and type of finish required, it is helpful for those making the various parts to see them working in their place in the complete machine, thus affording an opportunity for study of improvements.

Suggested improvements sometimes come from unexpected sources, therefore an assembled machine, and what is still better a machine in action, is a very fertile source for improvements not only from the manufacturing plant employees but from the general public.

It is well to give a new machine as wide publicity as possible.

H. B. Martin
Watervliet. N. Y.

•

Sometimes ignorance is bliss in more ways than one. However, a little knowledge never yet hurt a man. Sometimes it helps him get his job job done with greater ease. Most people like to brag. As Al states, it helps feed one's ego and talking about a company's product makes for some interesting discussions. Usually no harm is done by inexperienced personnel telling how the product is put together. Yet sometimes the smallest detail is all that the competitor needs to undersell. Information gets back in the queerest ways. Employees can oftentimes be a source which can do a great deal of harm through innocent remarks.

It has been quite widely accepted that if men know how the product they are making is used, they have greater interest in the work. Frequently they will do very much better work if they know why close tolerances must be met.

Ed's remark that it is the salesman's job to sell the product may be true, but if the employees are not sold on it the product will never be worth selling. A company makes a big mistake in not carefully educating its employees about the product

*COLOR

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they produce. It is not necessary that every man and woman in a plant actually see how the pieces of a product go together or how each individual product is made, but it is vital that they know where the company product is used, how it is sold and to whom.

Employee interest in a company is the life blood of industry. Proper interest in the product and the company grows. A lack of interest—and it gradually slides back toward the red side of the ledger and out of being. Of course, before employees in the shop can be expected to have an interest in the company or its production, the foreman and company staff must have a genuine interest in the product themselves.

If and when workers learn about the product, the engineers will be flooded with ways and means to do the job. Some of these ideas are good. It helps design better products because too many engineers are office or desk sitters. They don't see the practical side and lose many chances to make a cheaper product and yet retain the quality.

So to sum it up . . . educate your workers and it will pay off. Teach them all they can and will absorb. Tell them why and show them why parts must be produced to close tolerances. Get their ideas on how they think the product should be made. All this helps sell products, and today we need to sell them.

Charles D. Townsend
Centralia, Mo.

•

CAN ENGINEERS COME INTO THE SHOP?

I served an "engineering apprenticeship," worked about ten years in the shop to get some idea of what to design, and about 30 years in the engineering departments of various concerns and am chief designer where I am employed, so I feel I can approach the question from the viewpoint of both the machine-shop foreman and the designer.

Certainly the draftsmen should be permitted and encouraged to spend some time going through the shop to see how work is done and especially to follow through on their own designs. But they should not be permitted to change designs which have been turned over to the shop without the knowledge of the shop foreman. To do so will undoubtedly tend to undermine the authority of the foreman and create confusion.

Nobody is perfect, not even designers. We do make "technical errors" at times, and sometimes we think of a mistake we have made or a better way to do a job after it gets into the

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On metal-working tools the superior merits of Kennametal are manifest in longer life, reduced grinding expense, lower tool inventory, less machine down time, greater operator efficiency.

As parts of machines, particularly those subjected to wear, the noteworthy properties of Kennametal are evident in greater durability and better performance than ever realized with any other metal.

A new grade of Kennametal, developed to provide high resistance to oxidation at elevated temperatures, has many potential uses.

Our new Catalog 49 contains a wealth of information for metal-working plants. To secure your copy will be a good move. It suggests many subsequent moves that can be made to your advantage.

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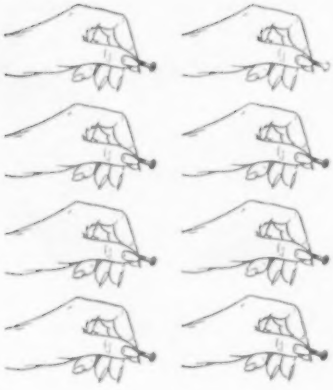

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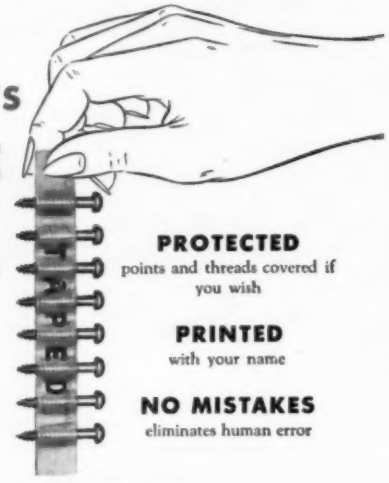

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shop. We should certainly be allowed to correct our mistake or improve our design at any stage in the processing of the job, but any additional expense caused by such changes should come through the shop foreman and be charged to the engineering department, and if the job is very far along and the cost is appreciable the designer should get the approval of the "higher ups" before putting any extensive change through.

By all means encourage the designers to go into the shop; it is unfortunate that so many of them have such a meager knowledge of shop practice; but following through on their job is just about the best way of learning what to do and what to avoid. A few sarcastic remarks from some of the older shop men may do more to show a designer the error of his ways than comments from his supervisor.

There is another side to this question that should also be stressed. That is the proclivity of some machine-shop foremen and machinists to change the designs of the engineering department without the knowledge or consent of the latter! When the machine-shop foreman or machinist thinks he sees a better way of doing the job, he should tell the chief designer about it and get his consent before making the change. The designer may have had some good reason for designing the job as he did which is not readily apparent to those in the shop. There are two sides to every question, and this one is no exception. While it is true the designer should not interfere between the shop foreman and his men, it is also true that the men in the shop should not interfere with a draftsman's designs without consulting and getting the viewpoint of the engineering department.

F. E. Fick
Cleveland, Ohio

•

There should be an understanding that the engineer is free to enter the shop and watch the job he has planned, for it sometimes occurs that as parts take shape in metal, it becomes more apparent where an interference may occur or the article may show signs of unhandiness that has not been apparent on the drawing.

It is not unusual, during making of parts, that desirable changes become apparent, to simplify machine work as well as improve the machine as a whole.

Very seldom does it occur that anything but the most simple piece of equipment is made without some

which job can you do better with Oakite metal-cleaners?

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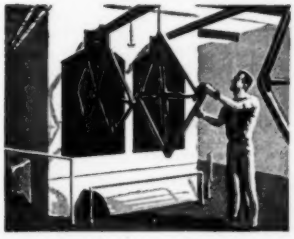
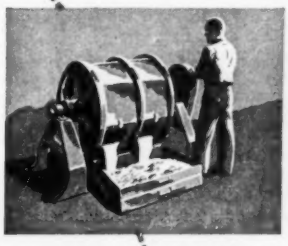


PRECLEANING? In spray-washing machines, Oakite Composition No. 97, emulsifiable solvent cleaner with water, removes buffing and other compounds from steel, cast iron, brass, aluminum, zinc. Gives temporary rust prevention. Use before electrocleaning, plating.



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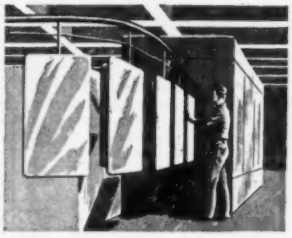

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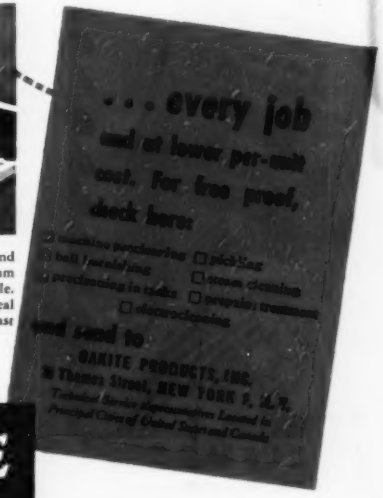

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Makers of hand and power hack saw blades, frames, metal cutting band saw blades and the Clemson Lawn Machine.

improvement being discovered in the course of construction. However, the shop foreman should be kept informed of all changes in construction and advised of their probable cost in material and extra time required to do the work.

No one knows better than the shop foreman what changes of material or shapes will delay and add cost to a job, thus making it vital for all concerned that he be kept posted on all changes.

John Mark May
Watervliet, N. Y.

•

I believe that the engineer, if he is up to his job, should have the angles all figured out before he sends the drawing down to the shop. If he should have any doubts about any one or all of the details of his drawing, and would like to follow them through the shop, he should first go to the foreman in charge and explain the situation to him. I am sure any fair-minded foreman would be willing to cooperate with the engineer and in so doing turn out a better, more workable product in a shorter time. Sometimes two heads are better than one.

I do not believe in anyone going over the head of any foreman—even the superintendent should go to the foreman first for the good of all concerned.

H. Manning
Port Huron, Mich.

•

One cannot blame Ed for getting hot under the collar about Thomas hanging around the shop. Ed has a duty to perform as a foreman and as such he should be privileged to direct every change made in his department. If Thomas were a new man on the drafting force it certainly wouldn't do him a bit of harm to spend some hours among the shop men, providing the purpose of his visit is made clear to the foreman.

It often happens that something is designed on paper and upon being constructed in the shop many weak points are evident. In this event it should fall upon the draftsman to consult with the foreman and discuss any changes to be made before the workman is informed. Occasionally something of an experimental nature needs to be worked out by the combination—draftsman and worker. I see no harm in this arrangement, provided it is understood beforehand. The shop foreman has his job to do and in order to do it effectively there should be nothing done to interfere in any way with his authority. It

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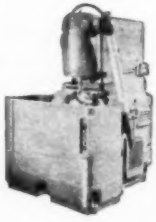

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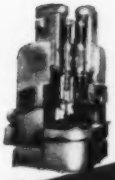

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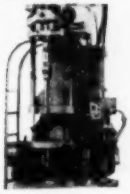
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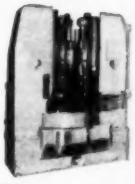
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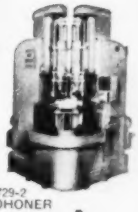
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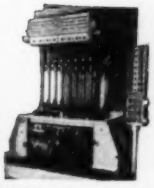
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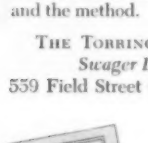

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places the foreman in a bad light.

I was involved in one of those discouraging three-way mixups many years past. The foreman, with whom I got along very well, gave me a job of boring out a large jig plate. Having no machine large enough to do the job in our small toolroom I was told to do the job on one of the vertical mills out in the main shop.

In proceeding with my assignment, I discovered many errors in the drawing and after repeated trips to the foreman, who in turn had to climb a flight of stairs to consult with the draftsman, I was told to work direct with the draftsman when any more difficulties arose. This I did with a clear conscience and if I wasn't running upstairs to see the draftsman he was running down to see me. I detected a glint in my foreman's eyes as the two of us were discussing things at the mill.

His attitude was never the same toward me after that, although I had no intention of going over the man's head. Here was a case of a foreman passing the buck on to me, in order to save himself a little physical effort. It taught me a lesson in foremanship psychology—that the foreman should deal directly with his men and that no engineering department representative should interfere even though that interference would remedy a mistake in judgment. If the foreman is going to run the boat let him do the steering.

J. Homewood
Ontario, Calif.

•

When the draftsman lays out his work, he finds that there are a number of different ways the job can be done. He decides which is the easiest or most practical and puts it on paper. After the job is started, he will get a better picture of the procedure by watching the actual work being done. If he notices any improvements that can be made, the logical thing to do is to make the changes. If the alteration is trivial, he should inform the operator and later make the corrections on his tracing or process sheet. Any major changes should be called to the foreman's attention.

This procedure will benefit the company in two ways. First, the quality of the work will be improved or the production rate increased. Second, the draftsman will gain more practical knowledge both from the standpoint of equipment available and results which can be expected. When the draftsman knows what equipment is on hand and what the capacity of each machine is, he can

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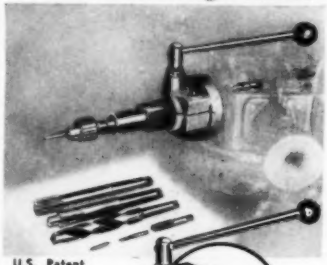

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Four posts are inserted in the cored corner holes, then bottom Inconel screen of close mesh is placed over grid to prevent shafts dropping thru. Two upper Inconel screens may be positioned by spacers, as desired, with mesh size to suit the work.

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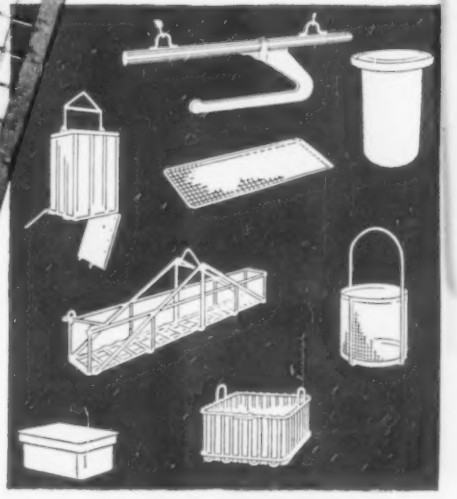

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lay out his design work accordingly.

I came across a print from a new draftsman one day which specified a broached hole. When I questioned it, I found that the previous company he worked for had broaching machines while our shop didn't. Another time he asked for a blind square hole about 4 in. long. This was not impossible with the equipment we had, but it required special handling and lots of time. When we suggested an alternate design which would serve the same purpose and make machining more practical, he objected. This piece cost the company four times its worth. This draftsman never came into the machine shop to see what equipment we had or its condition. He designed everything with the assumption that we had every machine tool available and that it was in perfect condition. When we continued to protest, the foreman called in the superintendent. A general conference was held, with the result that many of our machines were scrapped and new ones ordered as well as other types of equipment. When the new equipment was in operation, the draftsman laid out his work to fit the machines and everybody was happy again.

Of course it would be ridiculous to expect management to go out and buy a new machine everytime a draftsman recommended one, but there is no sense in having a designer if there is not proper equipment to carry out his requirements.

The engineer is a valuable asset to the foreman if he would take advantage of his services. Instead of resenting his presence he should become better acquainted with him and not hesitate to ask him to help him with his problems. By teaming up to handle each other's questions, both derive the maximum benefits from their efforts.

Frank J. Zarnowski
Rutherford, N. J.

•

The establishment of an arbitrary ruling that engineers stay out of the shop is a certain way of assuring a halt to the betterment of design of the product. Improvements in product engineering depend on the systematic use of experience, both design and shop acquired, and tie in with a more economical control of effort in manufacturing the product. The extent of the value of engineering contact with shop production of the designed item must be measured by the degree to which that contact will help make a better product at lower cost. Most progressive foremen have no quarrel with engineer-

▸Time-saving single spindle
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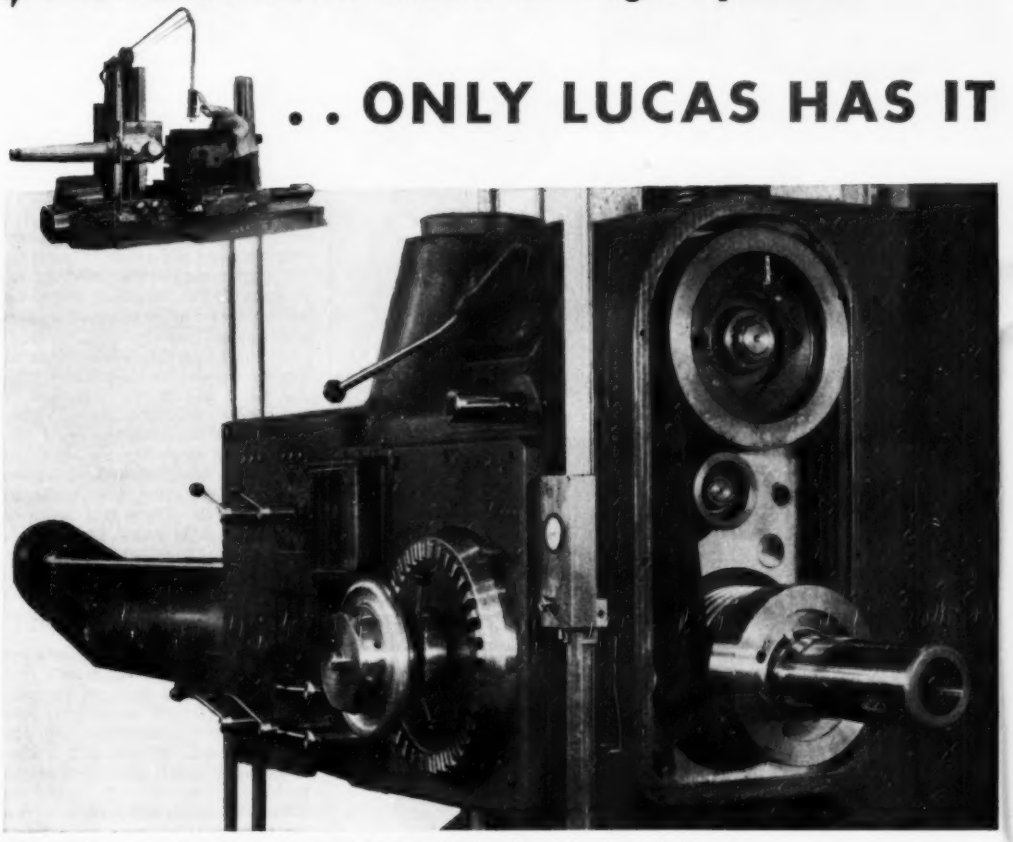

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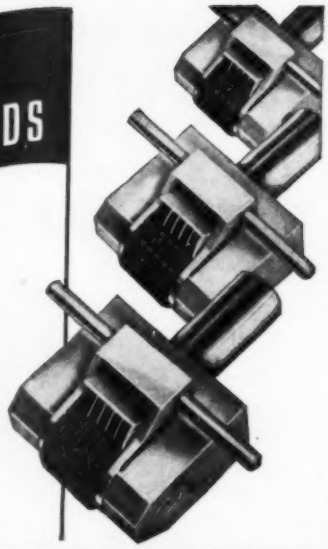

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ing department intrusion into the production field, provided foremen are consulted when changes are proposed.

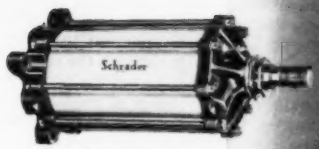
The designer of the product has a paramount interest in the manufacture of his brain-child. It is his baby and he normally feels a paternal responsibility for its successful completion as a working actuality. Design and drafting of the product come first; they provide the base for the structure which is to be built, and the engineering department is therefore deserving of the wholehearted support of all branches of the organization, particularly the shops, as represented by the foremen. Too many shop foremen are prone to consider the engineering department as an undesirable but necessary evil to be tolerated with a minimum of cooperation.

One point to the disadvantage of the large plant in comparison with the small one is the closeness of touch which usually exists in the latter. A new design in the small factory would probably combine the best that the president, designer, foreman and often the workman could give it. There is a sense of exclusiveness in many large plants which is like the lack of neighborliness in a large city, and too many times a new design is first seen or heard of in the shop when the drawings are sent down for use.

Infringement of the foreman's authority by the drafting room's representative in the shop can be minimized or avoided by proper consultation and conference between the interested foreman and draftsman, in an honest discussion of the problem. The draftsman, under no circumstances should seek to advise the individual worker on changing the product. He should contact the foreman first. The foreman, in turn, should realize that the draftsman usually has the skill and experience which enabled him to prepare the drawing containing the definite working instructions to those who are manufacturing the product, and therefore is entitled to a hearing in the shop and consideration from the foreman.

If a better product will result from this preliminary inspection of the work in process, there can be no valid objection by the foreman to permitting the draftsman to iron the bugs out of the product while it is still in the shop and before it gets out on the production line.

In the process of manufacture of a product as the designer's plan is translated into shop work, various transitory changes may take place in the details of the design as found



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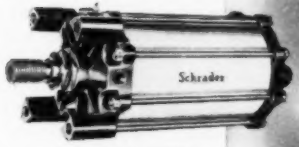
BOLT MOUNTING



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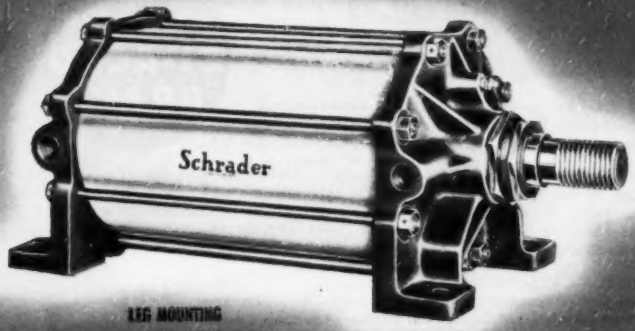

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Yes, do them faster and better at a saving in time and cost!

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You'll like them because they're made by Schrader. Write for complete air cylinder data.

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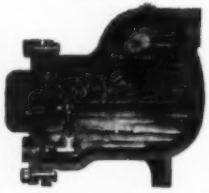

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necessary because of minor errors or shortcomings in the draftsman's work. It is also apparent that the design can benefit through the checking by the draftsman of the product while it is in process of production. Seeing the physical translation of the planned design may lead to improvements. However, there should be a hard and fast rule established that no changes are to be made by either designer or foreman unless authorized by responsible authority, after preliminary joint conference between foreman and designer.

Harry Kaufman
Philadelphia, Pa.

•

There are many points in favor of the engineering department coming in and following up on points of design. After all, these men are not infallible, can make mistakes, and sometimes when they see a device taking shape, they can see a chance for improvement in design that may save considerable expense or increase the efficiency. In my time I have encouraged the engineer or plain draftsman to check along with the men as work progressed, and this policy never gave me any trouble. It has also paid off for me in a large job shop by having our draftsman or myself recheck on prints as the work progressed. In one particular case, we had taken on among other items the making of the old-style double hinged windshield for autos. Our contract called for us to make our own tools at cost plus.

Expensive dies were under way. I decided to call our draftsman in to check with me on tools. The angle of these windshields on the old cars had to be correct to fit up under the top to exclude weather when necessary.

Our check showed my diemakers were coming along OK to drawing. As our drafting department was not overly busy, I had the draftsman get the car dimensions and make me a layout of our own. On checking this we found close to 1 in. of space would be left open at the top of shield. I could not believe my eyes. All dimensions seemed OK. So I finally phoned the customer. Their engineers department came—and behold, their car was going through almost 1 in. too high! I was informed that over 1,000 of these cars had been produced and had to be corrected. In such plants, drawings are checked and rechecked and very often complete models made up. Yet this thing got through to production of dies before discovered.

Several times in my experience I have seen the pattern made up

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above
• Size 2 plug-in starter unit

right
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NEW ***SPACE ECONOMY.*** Up to six starters fit in 20" x 20" x 90" sections. Standard 20" depth sections will accommodate starters through size 5.

NEW ***SAFETY DISCONNECT OPERATOR.*** One to four padlocks will lock both door and disconnect in either "ON" or "OFF" position. On closing unit door, handle moves to indicate position of disconnect. When not padlocked, authorized person with tool can release door interlock to inspect control without interrupting power.

NEW ***FLEXIBILITY.*** For simplest plant conversion or maintenance, plug-in units slide on guide brackets and positive pressure stabs grip round vertical busses. Plant conversion is simplified and minor changes often will not require shutting off power.

Square D's NEW Control Centers are also available in water-tight, dust-tight and weather-resistant enclosures. Contact your nearby Square D Field Engineer for complete information, or

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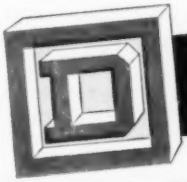

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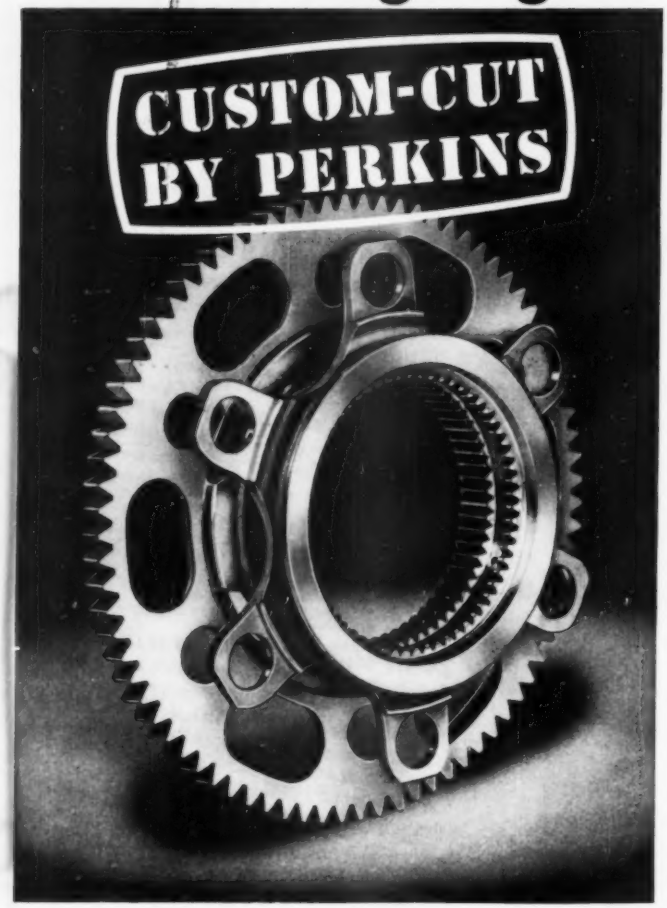
AIRCRAFT engine gears



The highly complex gear shown here, is an example of the exacting production jobs entrusted to us regularly by many of the country's leading manufacturers of aircraft engines. Moreover, our ability in the field of gear engineering extends into practically every industry. Thus a vast amount of *all* types of equipment in use right now has been built at less cost and operates more efficiently because Perkins' engineers checked the customers' blueprints and specifications prior to manufacture.

Broad experience both in the application and manufacture of all types of gears has equipped our staff to bring to your project a highly specialized knowledge of power transmission problems.

For the manufacture of the highest quality gears in production quantities, consult PERKINS first.

PERKINS MAKES—in all materials, metallic and non-metallic—Helical Gears, Bevel Gears, Ratchets, Worm Gears, Spiral Gears, Spur Gears with shaved or ground teeth, Ground Thread Worms

PERKINS MACHINE & GEAR Co., West Springfield, Mass.

wrong. A job comes in to the machine shop. The machinist starts work on it, and along comes engineering and discovers something was wrong before the machinist gets that far along. This saves further expense.

This type of checking has its merits and pays off in time and expenses saved. Now, on the other hand, we may have an over-officious engineering head who may take some advantages here and make things unpleasant for the tool or machine shop supervisor. That must be handled by the individual shop involved.

In cases where there is a large increase in cost or any changes in design the heads should always get together on the extent of the alterations. If they cooperate, I cannot see where there is any chance of friction.

I maintain our engineering has the shop's right to follow up the progress of his work and alter it if he deems the change either compulsory or beneficial. Let him be his own proofreader as much as possible.

Henry Rasmussen
Niagara Falls, N. Y.

•

It is essential that all members of the designing staff have utmost freedom to see everything in the manufacturing section. If they are kept away from the departments where their ideas are brought to fruition, the result will be expensive production. At the same time, their visits to other departments should be carried out with tact so it does not offend foremen and other production executives.

There is a growing tendency for draftsmen to have little or no shop experience. They leave school or college and start working in a design section without having any first-hand shop experience. In consequence, they follow the line of least resistance by turning out drawings with information reduced to a bare minimum and leave the production section to fill in the gaps. A close acquaintance with the shop, its plant and methods of working would result in cheaper production. An intelligent draftsman can reduce production costs by the exercise of a little more effort, backed by a certain amount of knowledge.

For instance, I had a tool draftsman working for me who had never worked in the shop. He used to follow the standard practice of many tool shops by stating that a part to be fitted to a baseplate should have its bolt and dowel holes copied through from the part. If he had taken the trouble to have a walk around the plant he would have seen that we had

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three jig-boring machines, and that we treated a tool job in a similar fashion to a production job. All fitting holes in any part were jig-bored and we employed no toolmakers. The tools were expected to fit together and be right first time without any hand work. I let him pry around in the works and he was soon turning out intelligent drawings

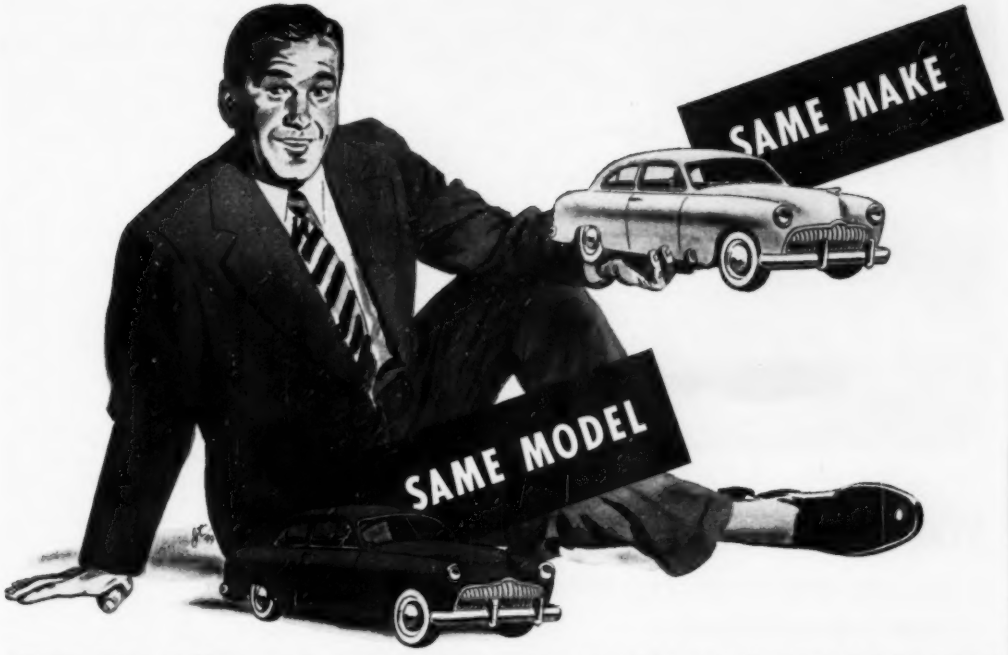
There will always be bickering and argument in a shop where the design and production personnel are segregated. A little more fraternizing between the sections will lead to better work through better understanding of each other's problems. I think that in tool shops, mutual cooperation is most essential. Tools are always too expensive and I have long been of the opinion that this is entirely due to tool designers leaving too much to the imagination of the toolmakers. Tool production can only be cheapened by tool designers making the drawings to suit the manufacturing plant available. They will never know the plant unless they visit it frequently.

Some men are born without tact and are always stepping on some other person's toes. Others are tactless through ignorance. Shop visits by design staffs should only be allowed when all concerned are fully primed as to the balance of power and authority.

No draftsman should directly approach a machinist without first seeing the foreman in charge and no foreman should try to raise a rumpus with a draftsman without first seeing the design department head. To earn mutual trust requires an appreciation of other people's feelings and viewpoint. It is just plain old-fashioned courtesy and good manners, but it pays dividends even in the rough and tumble of production.

F. E. Riley
London, England

"Can I borrow your torch, I have crepe suzettes!"



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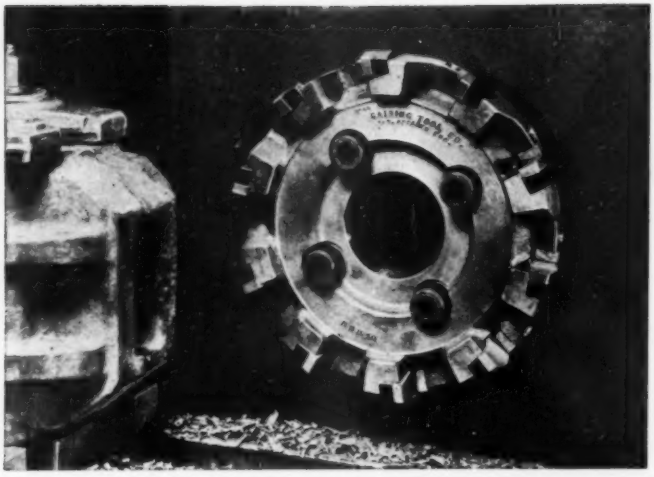

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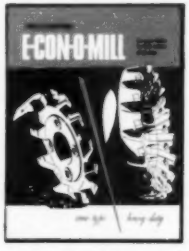

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NEW BOOKS

INSPECTION AND MEASUREMENT OF THE SHAPE OF SURFACES—*By Dr. Ing. Johannes Perthen. Published by Carl Hansen Verlag, Munich, Germany; 1949; 257 pages, 115 figures. Price, 28 German marks for half-linen covers. Printed in German.*

The term "shape" of a surface is intended here to cover the combination of surface roughness, waviness and lay, as understood in the United States (see American Standard B46.1-1948). The book discusses basic concepts of surface characteristics, various methods and instruments for (a) inspecting a surface visually or tactually (by "feel"), and (b) expressing the "quality" of a surface in terms of measurement, such as the arithmetic or rms average of the surface profile. The significance of the shape of a surface for the problem of producing interchangeable parts, and to the establishment of proper fits between mating parts, is reviewed.

The final section deals with the practical aspects of producing surfaces with different characteristics, from the viewpoint of design and manufacturing, and with the inspection and rating of surfaces based on measurement in the factory. A reference list of 949 books, articles, standards, etc., in German, English and French is annexed to the text.

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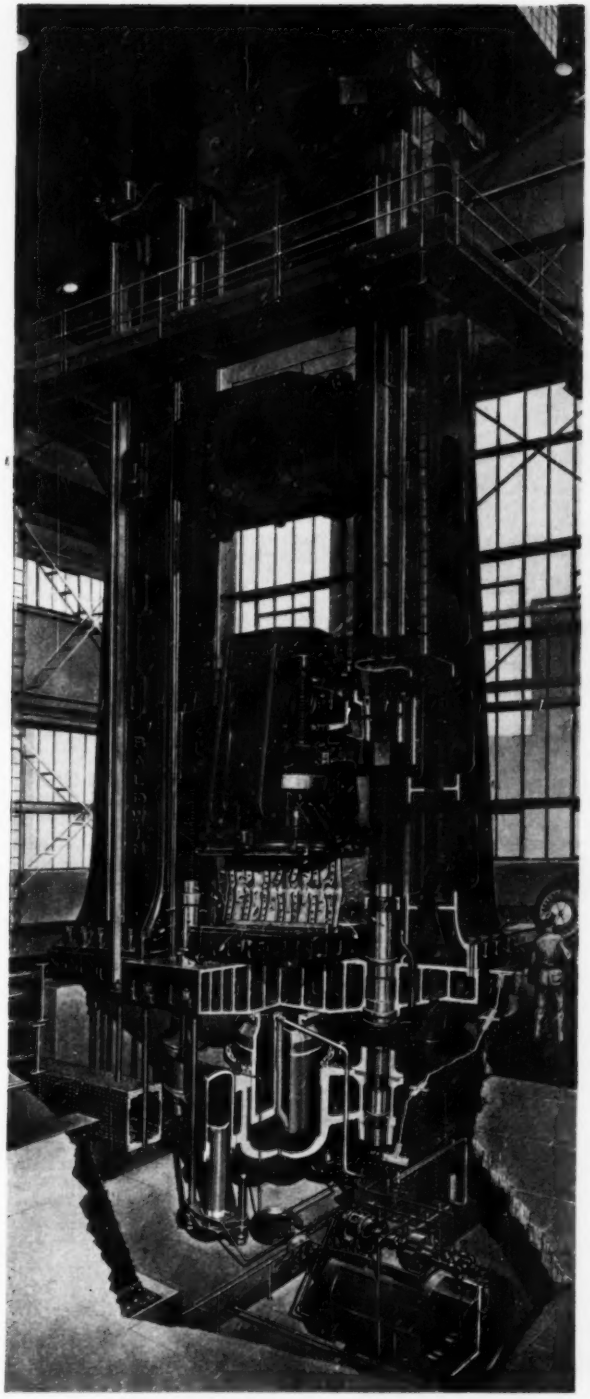
MATERIALS-HANDLING EQUIPMENT FOR MACHINE AND ASSEMBLY SHOPS—*By Dipl. Ing. Theodor Ricken. Published by Carl Hanser Verlag, Munich, Germany, 1949; 70 pages, 130 figures, 9 tables. Price, 5.80 German marks for cardboard covers. Printed in German.*

The subject is reviewed for the benefit of the production man, in sections covering the following subjects: Fundamentals, types and capacity of equipment, cost of operation. Equipment used in one place, particularly in combination with machine tools, for handling heavy work (example, crane hoists). Equipment used for transportation between different shops and between shops and the stockroom (pallets, lift trucks, tractors, overhead rail conveyors, etc.). Equipment used in assembling operations, such as overhead traveling cranes, mobile floor cranes and hydraulic jacks. Equip-



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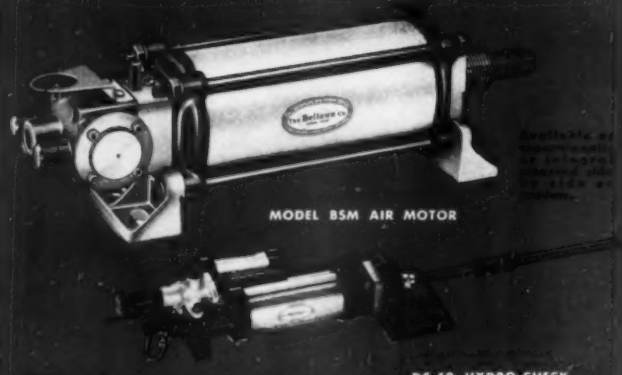

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OXYACETYLENE WELDING AND CUTTING —*By Stuart Plumley. Revised and rewritten by T. B. Jefferson, editor, The Welding Engineer. Published by McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. $6.50.*

Now in its fourth edition, this universally popular book has been completely revised and brought up to date by the addition of valuable new material. It constitutes a complete course of instruction in the use of the oxyacetylene flame for cutting, welding, brazing and hard facing, with step-by-step information and illustrations. Nothing is taken for granted, and all instruction is based on the assumption that the reader knows nothing whatever of the subject.

Considerable space is devoted to pipe welding and to newer techniques in alloy steels, aluminum and magnesium. Also included is useful information on the establishment and operation of a job shop, and methods of cost accounting for various kinds of jobbing work.

•

OPTICS IN PRECISION MEASUREMENT TECHNIQUE—*By Dr. Ing. Kurt Raentsch. Published by Carl Hanser Verlag, Munich, Germany, 1949; 317 pages, 520 illustrations. Price, 30 German marks for half-linen cover. Printed in German.*

The author, a scientific collaborator of Zeiss Works, deals with the subject from the viewpoint of the industrial user of optical instruments, rather than their designer. One-third of the book discusses the principles of the industrial use of optics, including a treatise on the phenomena, reflection and refraction, the geometrical and physical principles of optics, and optical systems producing images, such as photographic lenses, magnifiers, microscopes and telescopes. This section also covers the optical properties of the eye, such as the powers of accommodation, adaptation and resolution.

The remaining two-thirds of the book reviews the various types of instruments (of German make only),

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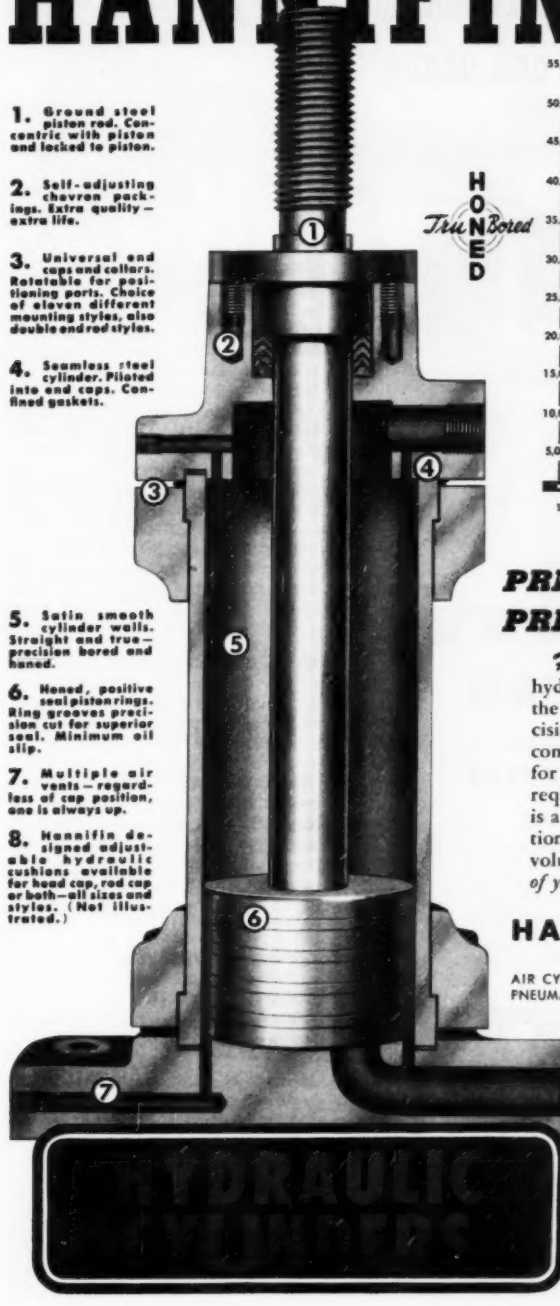

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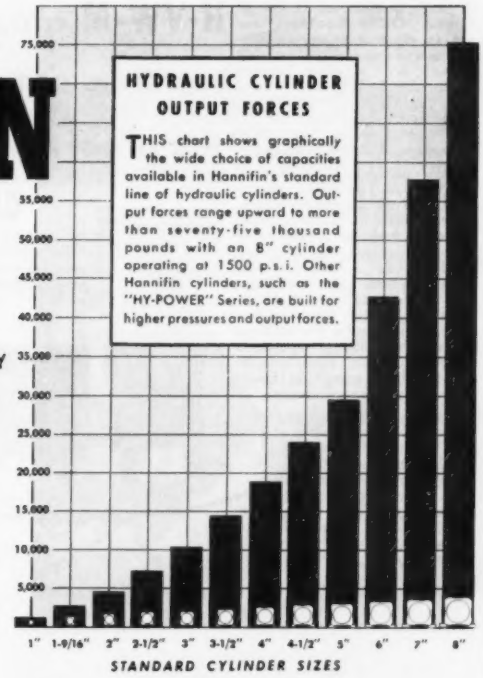

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THIS chart shows graphically the wide choice of capacities available in Hannifin's standard line of hydraulic cylinders. Output forces range upward to more than seventy-five thousand pounds with an 8" cylinder operating at 1500 p.s.i. Other Hannifin cylinders, such as the "HY-POWER" Series, are built for higher pressures and output forces.

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divided into a group including instruments with optical systems producing images, and a group of instruments where the inspected object directly influences the path of the lightrays, as in the application of interference methods by means of an optical flat, or the interference comparator used in checking gage-blocks.

•

METALLURGY AND MAGNETISM, *By James K. Stanley, Sc.D., research metallurgist, Westinghouse Research Laboratories. Published by American Society for Metals, Cleveland. 150 pages. Price $4.*

As far as is known, this book represents the first attempt to treat systematically in one volume the factors affecting magnetic quality. Chapter headings are, 1) Magnetic Theory & Definitions, 2) Types of Magnetic Materials, 3) Factors Affecting Magnetic Properties, and 4) Magnetic Analysis. The latter tells plant metallurgists and research workers how changes in various magnetic properties can be used to study metallurgical and solid-state problems.

This text could be used as an introduction to ferro-magnetism and the various types of magnetic materials.

•

WHO'S WHO IN PLASTICS—*Published by The Society of The Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y. 244 pages, 6x9 in.*

This is basically a membership list, by individuals and by companies, of the SPI. It also includes, however, the-by-laws of the Society and extracts of major committee reports, regulations and proposed standards.

•

LOCOMOTIVE WHEEL BALANCING — *By George W. McArd. Published by Emmott & Co. Ltd., 31 King St. West, Manchester 3, England. Price: Two shillings.*

Number 44 of the Mechanical World series of monographs, this short, but highly instructive booklet gives detailed information on the factors to be considered in balancing the wheels of two, three, and four-cylinder locomotives. Drawings are given for virtually every type of wheel and cylinder combination, and balancing formulas and methods of solution are presented for each case.

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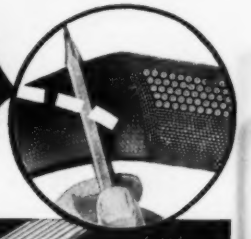

When a *straight-sided* V-Belt bends around a pulley, three things are bound to happen.

(1) The top of the belt, being under tension, *narrows.* (2) The body of the belt, under compression, *widens.* (3) The sides of the belt *bulge out.*

These *shape changes* are inevitable. They are shown in figures 1 and 1-A, below.

Straight-Sided V-Belt.

How Straight-Sided V-Belt Bulges In Sheave-Groove.

Because this bulging belt does not fit the sheave groove, two facts become clear. (1) The belt will get excessive wear where it bulges—*shorter life!* (2) The whole side of the belt cannot *uniformly* grip the pulley—*a loss in drive efficiency.*

How different the V-Belt with the precisely engineered *concave* side (U.S. Patent No. 1813698)—the Gates Vulco Rope. As this belt bends it assumes a shape that *exactly* fits the sheave groove. (Figures 2 and 2-A, below.)

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit In Sheave-Groove.

Two savings result. (1) The Gates Vulco Rope wears evenly—*longer life!* It's entire side-wall grips the pulley—no slip—*full delivery of power!*

The Mark of SPECIALIZED Research

The Concave Side is MORE IMPORTANT NOW Than Ever Before

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Now that Gates *SPECIALIZED* Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side is naturally more important in conserving belt life today than ever before.

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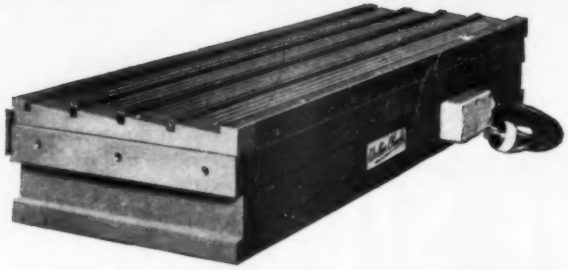

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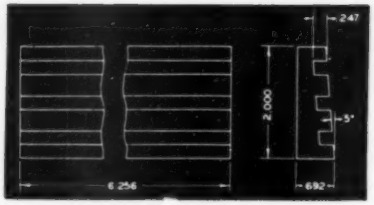

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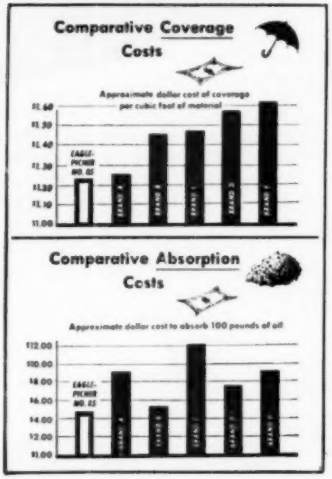

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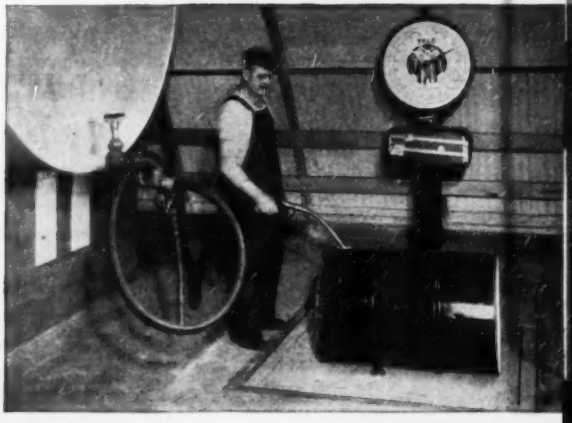

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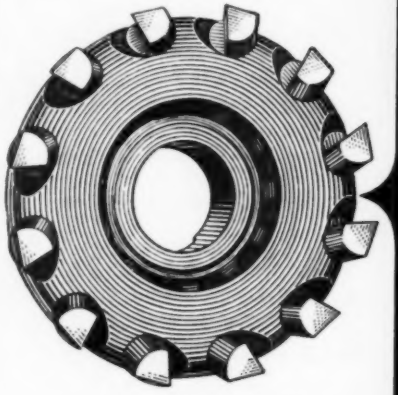

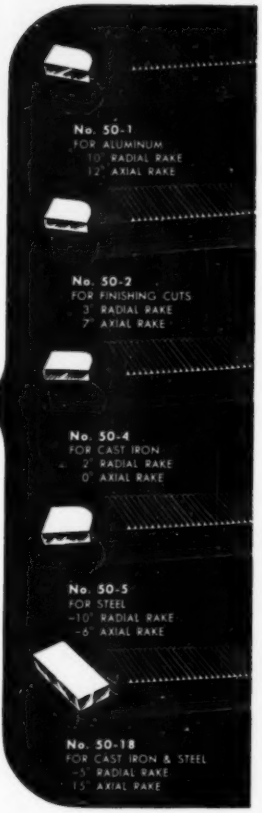

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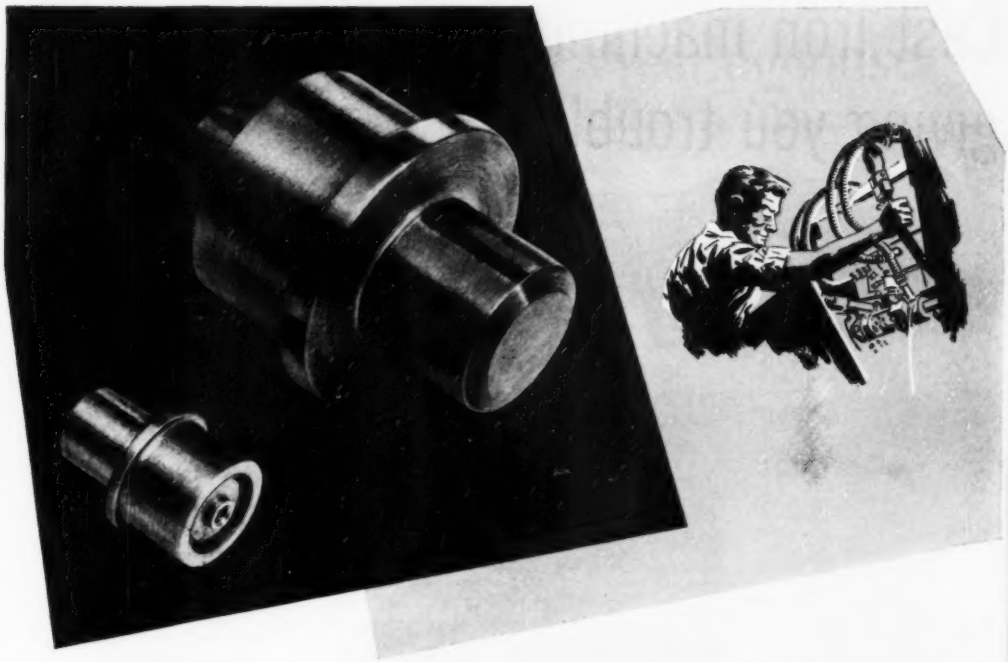

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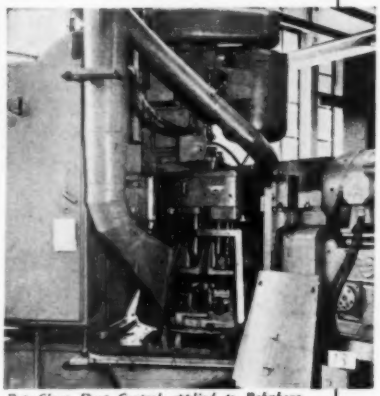
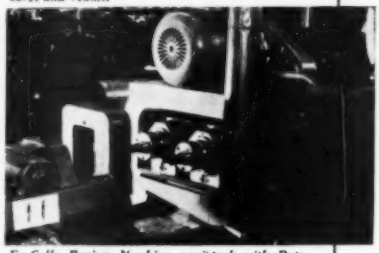
IF SO, YOU'VE GOT A JOB FOR ROTO-CLONE DUST CONTROL



Roto-Clone Dust Control applied to Rebuberg-Jacobson Automatic which mills, drills, counterbores and reams.



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Since February, 1949, Life-Line motors have offered you the broadest exchange plan in industry. All 1 to 20-hp, single-phase and three-phase a-c motors in frame 203 to 326 are included. No other manufacturer of motors—large or small—provides exchange service that compares in scope to this new Life-Line Motor Exchange Service.

120 Westinghouse exchange points assure you rush motor replacement service anywhere in the United States. Replacement motors, covered by this plan, are in stock, ready to be speeded to you at any time.

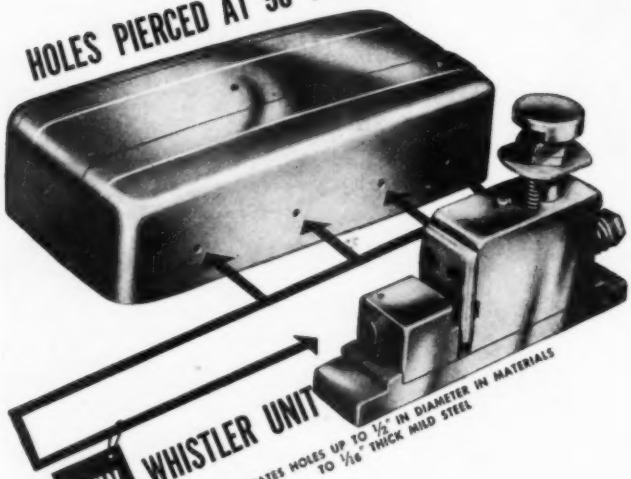
And what's more, if a motor fails during warranty period, it may be exchanged *free* for a motor of identical rating. The *exchange price,* beyond warranty, *is not dependent on the time in service . . . one year, five years or ten years.*

This service is one more advantage you get with Life-Line motors. Add this to all-steel construction . . . pre-lubricated bearings . . . an indicated savings of $750 per year per 100 motors . . . and you'll see why Life-Line has gained leading acceptance in the motor industry.

Complete details on the Life-Line Exchange Service—lists of exchange points and motor ratings covered—are given in the new booklet SM-5243. Get your copy today from your nearby Westinghouse representative or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-21533

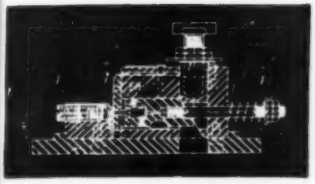
Westinghouse *Life-Line* Motors

HOLES PIERCED AT 90° ANGLE...

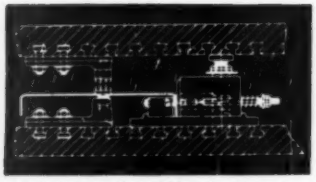


with NEW WHISTLER UNIT

PERFORATES HOLES UP TO ½" IN DIAMETER IN MATERIALS TO 1/16" THICK MILD STEEL



Detailed drawing showing simplicity of construction and all operating parts of the HU-50 90° Perforating Unit.



Typical set-up shows 90° perforating unit operated in conjunction with standard perforating equipment.

DETAILS EXPLAINED IN CATALOG NO. 48

Get the facts about this 90° perforating unit in a hurry. Your copy of this catalog will be sent at once upon request.

● Extruded shapes, ells, angles and other molded, shaped or fabricated pieces are easily pierced from the side at 90° with HU-50 Perforating Units. Quickly set up and adjustable, these units may be used separately or with standard perforating equipment. The advantages provided by other Whistler Adjustable Dies are retained.

Absolute accuracy is assured. Quick change-over of hole arrangements can be made... in many cases, on the press. Production economies and speeded up operating schedules are effected. Continued re-use of units in different groupings spreads initial cost.

It makes sense to look into the use of Whistler Adjustable Dies for all perforating, notching, slitting or rounding operations.

S. B. WHISTLER & SONS, INC.

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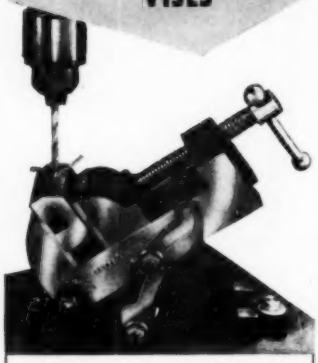
Jig in a Jiffy

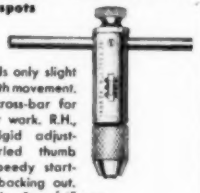
"YANKEE"

ANGLE VISES



Easily converted to fast-acting, economical jig. Shortcuts costs on small jobs. Lock the work in the "Yankee" Angle Vise. Tilt for the angle and lock. You're set up for every operation . . . hand or machine. Also available with quick-release swivel base. Two jaw widths . . . 2" and $2\frac{3}{4}$". Each vise supplied with grooved "V" Block for holding rounds.

"Yankee" Ratchet Tap Wrenches for tight spots



Ratchet needs only slight back and forth movement. Adjustable cross-bar for close-quarter work. R.H., L.H. and rigid adjustments. Knurled thumb piece for speedy starting in and backing out. Two lengths for 0 to $\frac{5}{16}$" taps, one for 0 to $\frac{3}{8}$" taps.

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From the *first* roller bearing available to industry, to the millions now produced annually, Hyatt Roller Bearings have been built to *last*.

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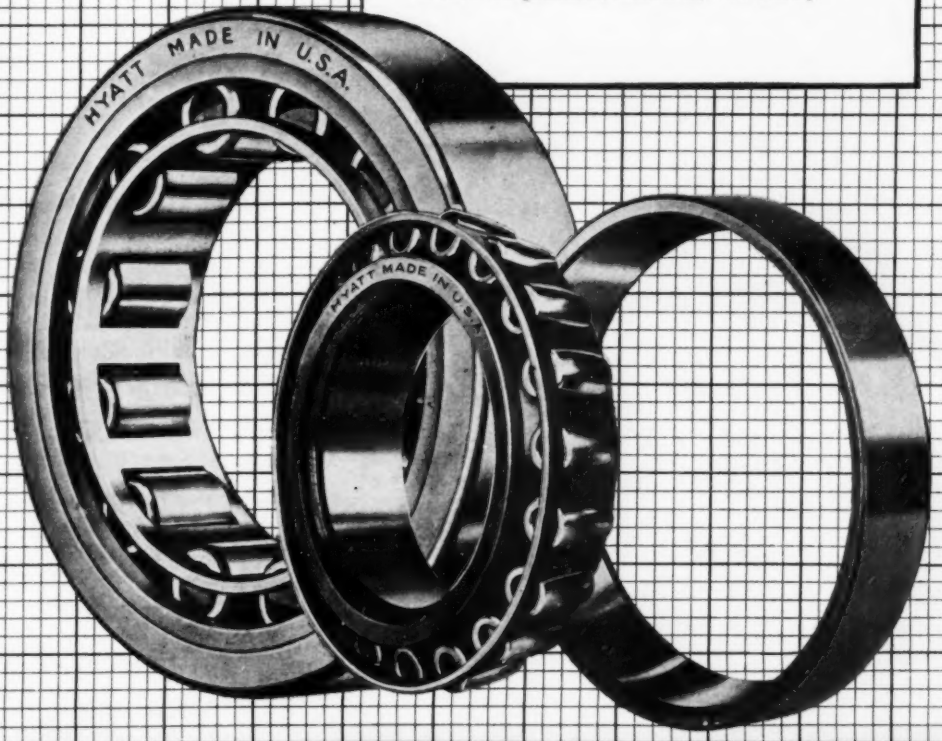
Your selection of Hyatts is an assurance of complete satisfaction to all concerned in the building and operation of modern machines and equipment. Hyatt engineering service is yours on request. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.



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DP Range.....1¼ DP to 16 DP
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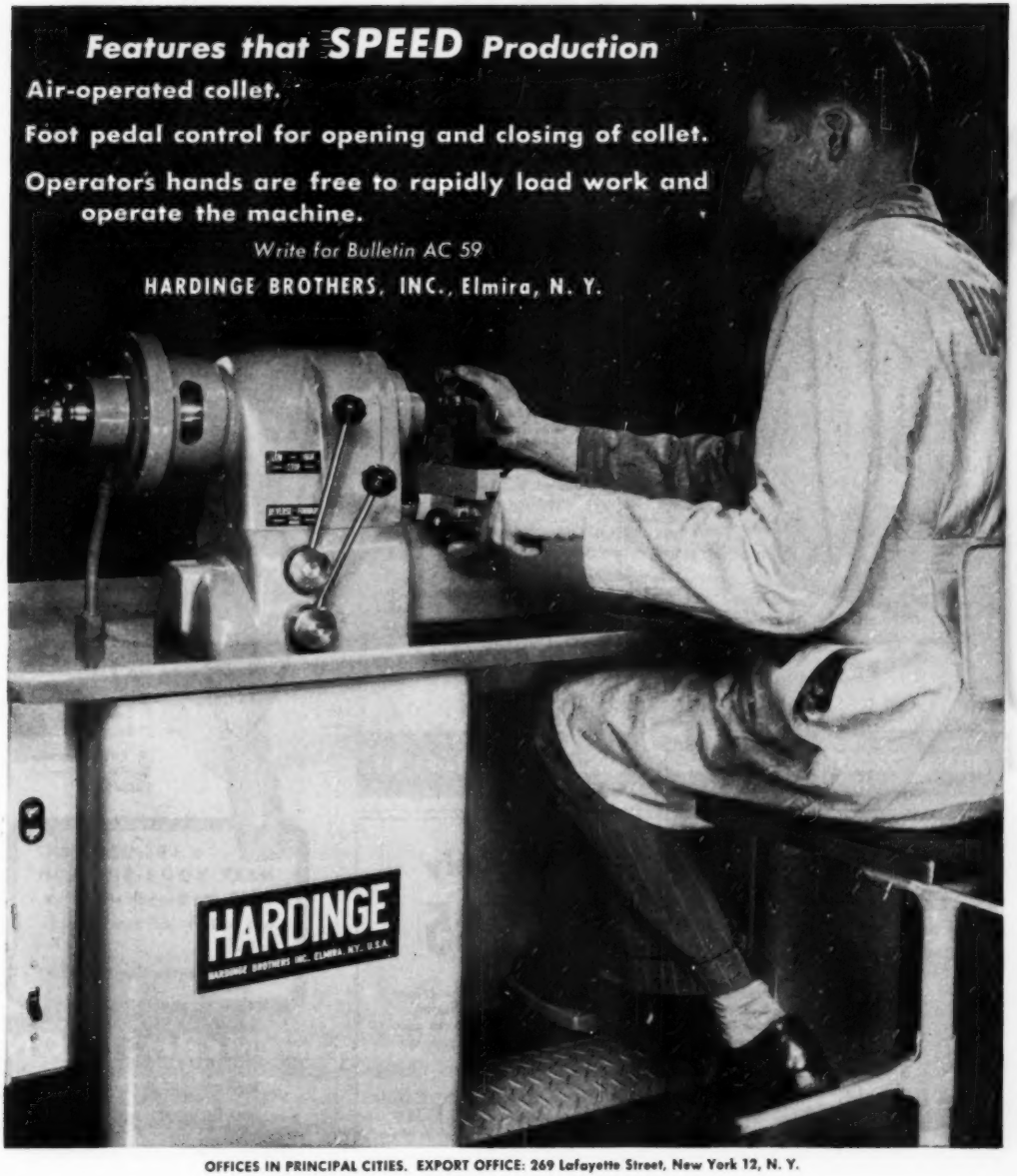
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Write for Bulletin AC 59
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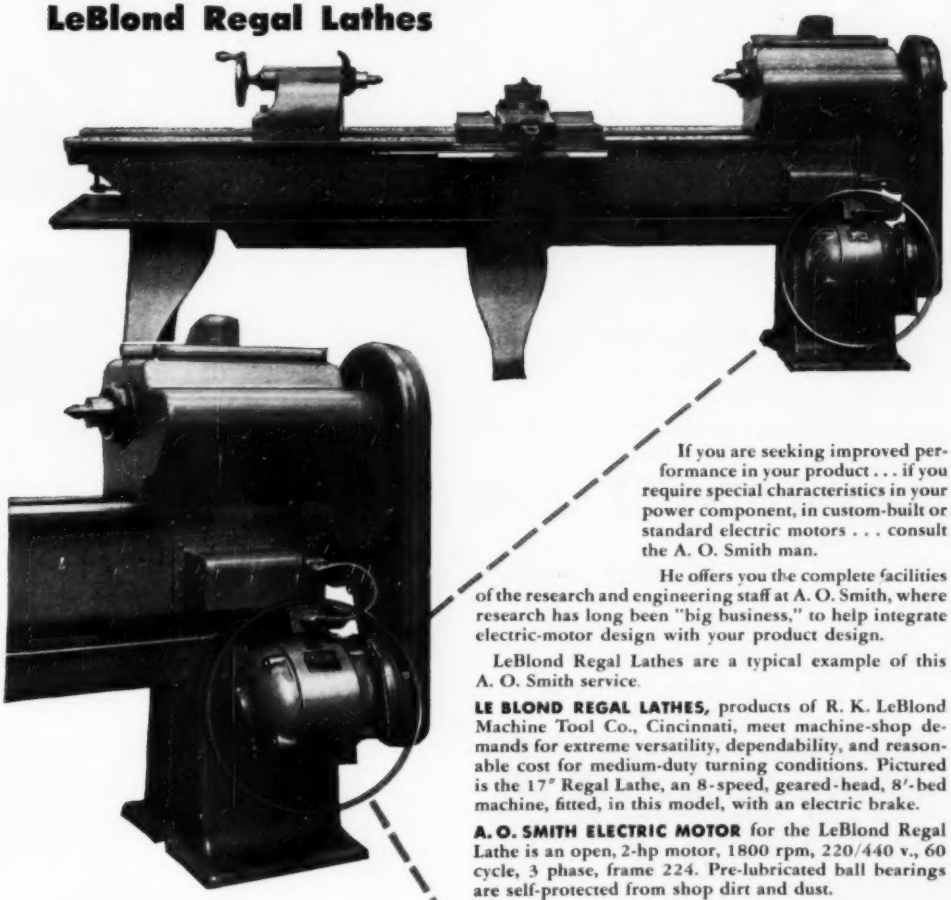
for hundreds of products, including

LeBlond Regal Lathes



If you are seeking improved performance in your product . . . if you require special characteristics in your power component, in custom-built or standard electric motors . . . consult the A. O. Smith man.

He offers you the complete facilities of the research and engineering staff at A. O. Smith, where research has long been "big business," to help integrate electric-motor design with your product design.

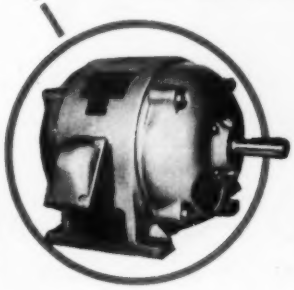
LeBlond Regal Lathes are a typical example of this A. O. Smith service.

LE BLOND REGAL LATHES, products of R. K. LeBlond Machine Tool Co., Cincinnati, meet machine-shop demands for extreme versatility, dependability, and reasonable cost for medium-duty turning conditions. Pictured is the 17" Regal Lathe, an 8-speed, geared-head, 8'-bed machine, fitted, in this model, with an electric brake.

A. O. SMITH ELECTRIC MOTOR for the LeBlond Regal Lathe is an open, 2-hp motor, 1800 rpm, 220/440 v., 60 cycle, 3 phase, frame 224. Pre-lubricated ball bearings are self-protected from shop dirt and dust.

Ask the A.O. Smith man about electric motors for both special and standard uses

WRITE FOR BULLETIN NO. EM-152



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To more than 200 authorized service stations, A. O. Smith Product Service Division provides fast, low-cost electric-motor service, on a 24-hour, off-the-shelf basis. Factory Service Branches and Warehouses at Union, N. J., Chicago, Dallas, Los Angeles.

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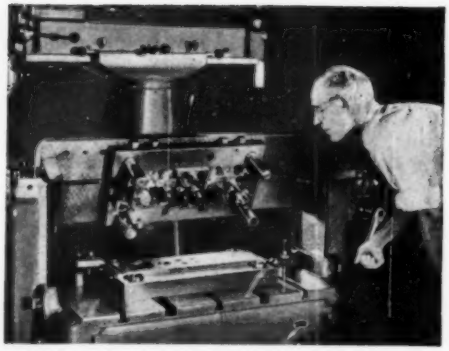
Hand methods are slow and costly.

Die assembling now mechanized



With the Moore Die Flipper 1 man does the work of 3.

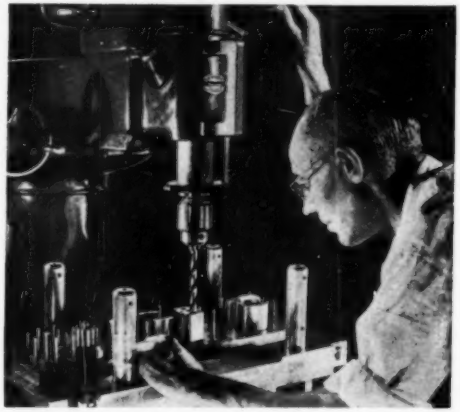
Is your toolroom still in the grunt-and-groan era of trying out and assembling large dies? Then it's time you investigated the revolutionary new Moore Die Flipper.

Without physical effort one diemaker can perform all the operations of die-assembling: Take apart, turn over, drill, tap and try out. The Die Flipper will be a money-saver in your toolroom from the start, for it can also be kept busy as a radial drill.

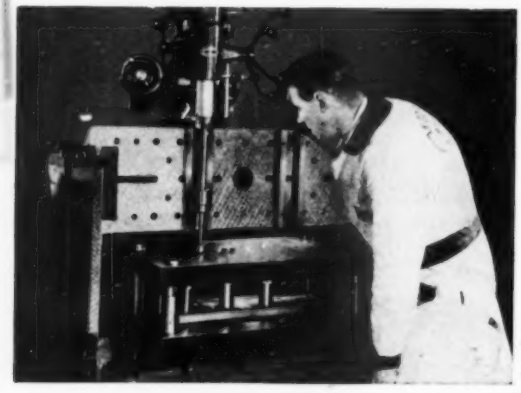
An eight-page catalog, with over 20 photographs and drawings, is just off the press. It's yours for the asking.

MOORE SPECIAL TOOL COMPANY, INC.

738 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

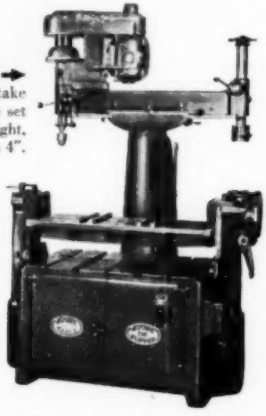


Drilling punch in place. Spring holes are also drilled. Radial drill has 1½" capacity. Tapping is done in same set-up with Lassy Tap Set.



← Counterboring for heads of screws tapped into punch flange, showing the use of ¾" chuck with long shank.

Moore Die Flipper stands → 5'x6'x7½' high. It will take apart and flip over a die set 20"x40" with 12" shut height, pins engaged in bushings 4".



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JIG BORERS **JIG GRINDERS** **DIE FLIPPERS**

PANTO-CRUSH WHEEL DRESSERS **HOLE LOCATION ACCESSORIES**

How to Give Your Boss Relief from "COST-ITIS" Headaches and Get Yourself a Raise!

How about doing your boss a favor, and a good turn for yourself, at the same time? We mean a *money-saving* favor for your boss, and a money-*making*, *salary-raising* boost for you.

Your boss needs the answers to a lot of 64 dollar questions right now. Answers, like what to do about profits being squeezed, prices under pressure, sales declining, costs already cut to the bone, but *still too high*.

And the biggest headaches of *all*, are his *"COST-ITIS" HEADACHES!* Give him relief from that dizzy problem, and he will know how to lick the others.

But often your boss can't see the forest for the trees. So we're tipping you off to a cost-cutting way he *ought* to know about, but often *doesn't*, because somebody in the plant took him too literally, when he said: "No more capital expenditures."

That way, is the material handling Automatic Electric Truck way that can *cut your material and product handling costs* AS MUCH AS HALF!

If you're using antiquated, manual handling methods of *lifting* and *moving* your products, it's a cinch that amazing, low original cost Automatic Electric Trucks are just what you and your boys need to lighten your work and go home at night practically daisy fresh.

And for the boss, it's the" COST- ITIS" *headache relief* he will happily pay off on, and the *payee* might as well be *you!*

So mail the coupon, and get all the money-saving facts about these famous industry-tested electric trucks. Find out how, with effortless, easy finger-tip-control, they lift, move and stack hundreds of pounds or tons and tons so easily, a stenographer could operate them in a breeze.

Yes, these mighty giants of electric power *do all the work*. One man accomplishes as much as three men doing fatiguing *manual* handling. The other two can be moved to more productive, *better paying* jobs.

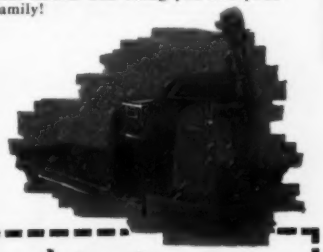
That's *cost cutting* that pays off for *everybody!*

So, before the boss says: *"There must be something wrong here, boys,"* give him the Automatic Electric Truck money-saving story. When you show him literally thousands of dollars he can save *without* cutting wages, and *without* layoffs, he will take back that order: "Lay low on capital expenditures."

Because, as *you* and *he* can see, cutting material handling costs with Automatic Electric Trucks is not a capital expenditure, but a money-maker for *everybody*... management, white collar workers, and labor.

So again we say: mail the coupon, read up on the fascinating facts we give you, and then trot upstairs and really show the boss *something!* He will listen, he will be amazed, he will buy.

And start planning now, *all the extras* that *RAISE* will bring you and your family!



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We have had many years of experience in originating and developing hot and cold forging equipment and methods. Our engineering staff, our entire organization is always at your service to help you solve your forging problems. Send us blue prints, a sample of the part you wish to make, or better yet, visit us. Chances are, we can help you.

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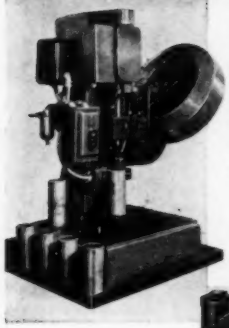
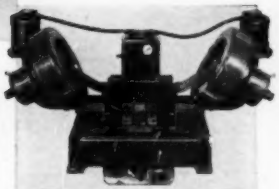


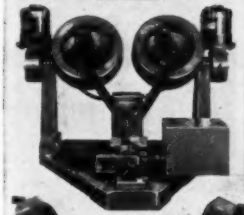
Motorized Hopper Units by the Detroit Power Screwdriver Company are "tailor-made" for special assembling applications . . . They eliminate the manual handling of parts . . . Let us solve your production assembling problem . . . Contact us now; send special assembly and component parts for quotation.

•

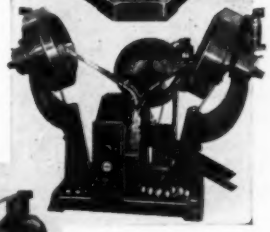
Pressing terminal studs in dry cell batteries.



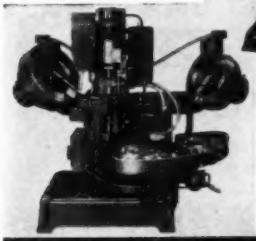
Assembling small hardware hinges by inserting two hinge pins simultaneously.



Inserting mounting screws in cooking utensil handles.



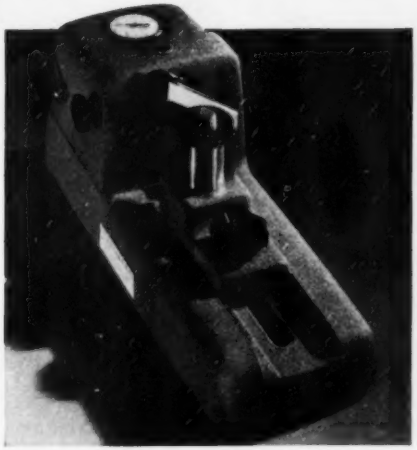
Automatic assembly of toy plastic wheels and axles.



Assembling screw and fibre washer to cable clamp for electrical outlet box for shipping purposes.

DETROIT POWER SCREWDRIVER CO.

2797 W. FORT ST. • DETROIT 16, MICH.



CHECK GEARS BEFORE THEY'RE FINISHED

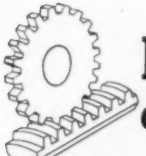
● This is a Kodak Backlash Gage. It's a workbench form of the Kodak Conju-Gage principle, a new money-saving idea that helps you make sure you're passing every good gear, rejecting the ones that'll make trouble.

The Kodak Backlash Gage is a sturdy, quick-reading instrument for an operator to use in setting up a gear-cutting machine accurately and for checking backlash under operating conditions. Essentially, it measures departure from a standard center distance between the gear and a Kodak Conju-Gage Worm Section.

That Kodak Conju-Gage Worm Section is the key to the precision, economy, and versatility of this new method for checking gears, in production and final inspection. A single Worm Section is accurately conjugate to gears of any helix angle and diameter as long as the normal pitch and pressure angle are the same. It can be made more accurately than circular master gears, is easily checked, and can be reground repeatedly to its original specifications.

Write for booklet giving full details.

EASTMAN KODAK COMPANY
Industrial Optical Sales Division, Rochester 4, N. Y.



Kodak
CONJU-GAGE

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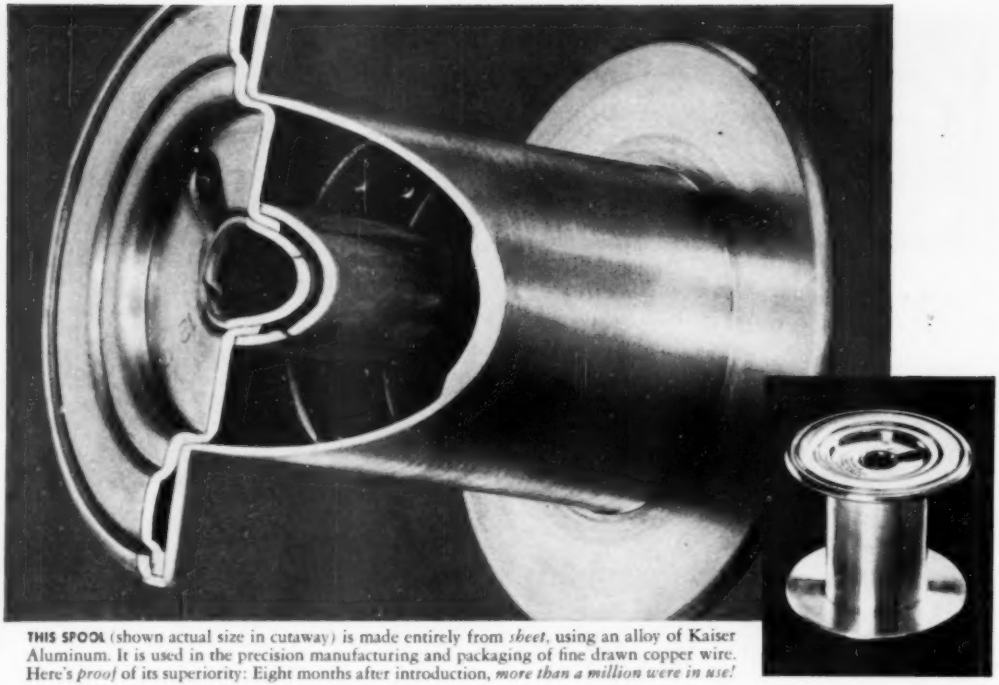


THIS SPOOL (shown actual size in cutaway) is made entirely from *sheet*, using an alloy of Kaiser Aluminum. It is used in the precision manufacturing and packaging of fine drawn copper wire. Here's *proof* of its superiority: Eight months after introduction, *more than a million were in use!*

One word tells why this spool is superior!

THAT WORD is . . . *aluminum!* It gives this product a combination of advantages no other material can match!

Some of the advantages the manufacturer realizes with Kaiser Aluminum might give *your* product more sales appeal! Read about them:

1. With Kaiser Aluminum, this spool's weight is only half that of one made of other materials of equal strength and rigidity. Which means important freight savings are made *repeatedly*, because these spools are shipped and returned for use again and again.
2. Kaiser Aluminum gives the spool dynamic stability, so necessary with high speed winding and unwinding. That's because aluminum combines lightness with strength and rigidity. And its exceptional workability means precision accuracy of all parts.
3. The life of the spool is longer by far, because Kaiser Aluminum resists corrosive action of acids and gases.
4. Copper wire can be annealed directly on this spool, without the flanges toeing out under pressure. That's because aluminum's co-efficient of expansion is slightly more than copper's.
5. And finally, Kaiser Aluminum gives the spool an extra sparkle of saleability! It will retain its good looks, too, without the necessity of plating, polishing or buffing, and it can't rust.

You can effect fabricating economies by using Kaiser Aluminum, too! Fewer man hours, fewer manufacturing steps, more economical equipment are the rule.

Whatever you manufacture, wouldn't you like to realize the advantages of Kaiser Aluminum in *your* product? Call in a Permanente Metals' engineer for help with the answer!

Permanente Metals

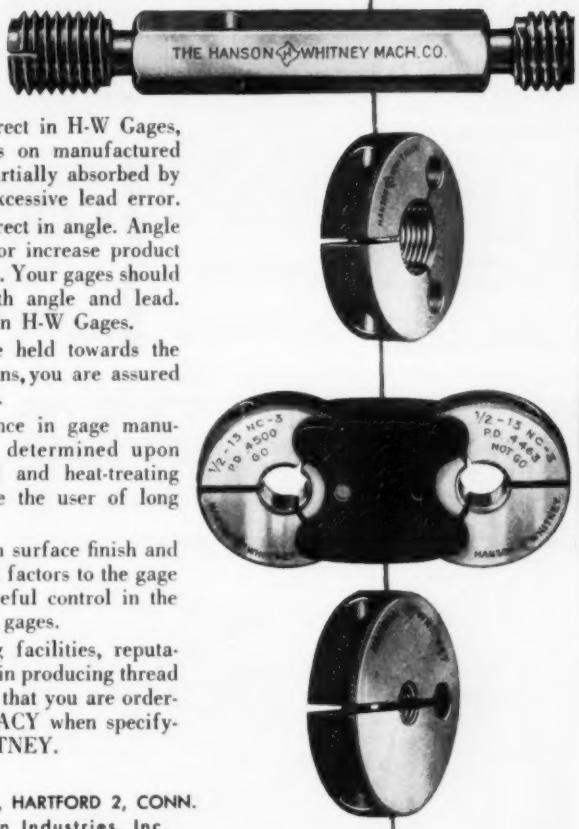
PRODUCERS OF

Kaiser Aluminum

Sold by PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND 12, CALIF., *with offices and Warehouse Distributors in major cities.*
EXPORT OFFICE, OAKLAND, CALIF.

CHECK THREAD DIMENSIONS OF YOUR PRODUCT WITH Hanson-Whitney GAGES

Factors to be considered when ordering Thread Gages and reasons why you should specify HANSON-WHITNEY.



LEAD: Thread lead is correct in H-W Gages, therefore tolerances on manufactured products are not partially absorbed by using gages with excessive lead error.

ANGLE: H-W Gages are correct in angle. Angle error plus lead error increase product manufacturing costs. Your gages should be checked for both angle and lead. Both are accurate in H-W Gages.

WEAR: As H-W Gages are held towards the high limit dimensions, you are assured maximum gage life.

MATERIAL: From long experience in gage manufacture, H-W has determined upon grades of material and heat-treating methods that assure the user of long gage wear.

FINISH: Correct and uniform surface finish and hardness—important factors to the gage user—are under careful control in the production of H-W gages.

FINALLY: H-W manufacturing facilities, reputation and experience in producing thread gages are insurance that you are ordering GAGE ACCURACY when specifying HANSON-WHITNEY.

HANSON-WHITNEY MACHINE CO., HARTFORD 2, CONN.
Division of Whitney-Hanson Industries, Inc.

For practical recommendations submit your problems to Hanson-Whitney engineers.

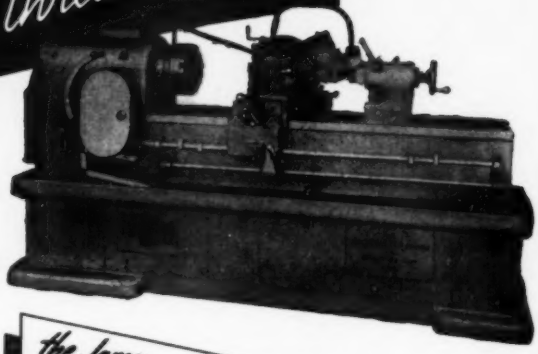
Hanson Whitney

PIONEERS OF FINISHED TAPS

SHW49

ALWAYS OUTSTANDING
NOW IT'S
EVEN BETTER!

the Coulter
Threadmaster



Check and Compare...

MORE DEPENDABLE Anti-friction bearings and spiral and worm gears in Cutter Spindle Drive.

MORE EFFICIENT Full size spindle and balance wheel on both ends of Cutter Spindle Drive.

MORE CAPACITY 59 speed changes possible with standard equipment. Cut threads from 1/3 to 20 per inch and diametral leads from 7 to 20 in single, double and triple worms, and leads from .050 to 3.000.

MORE PRODUCTION Mill hard and soft materials with carbide tools.

WRITE FOR PARTICULARS about the "THREADMASTER"... the Thread Milling Machine of tomorrow . . . threading it better and faster, today!

the James **COULTER** *Machine Co.*

The Thread Milling Machine that produces long and short precision traversing elevating, cross-feed and lead screws in LESS TIME!

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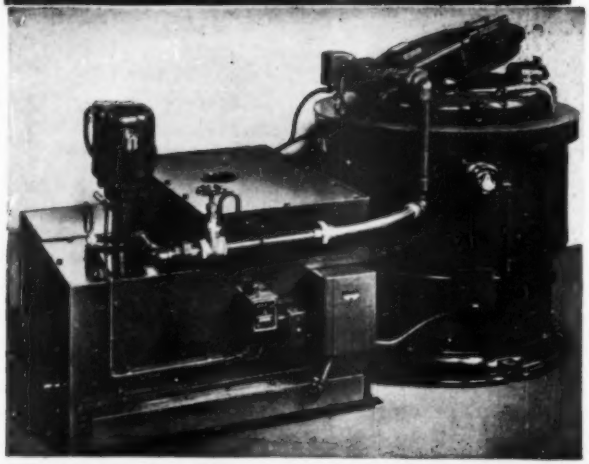
CONTROLLED IMPREGNATION by the BARRETT "HYDEWA" Centrifugal Process offers many advantages



The Centrifugal Process is limited in application only to the size of the articles that may be rotated in fair balance in the revolving bowl. Coils, condensers, transformers, braiding cotton insulated wire, paper tubes, pressboard spacers, rawhide and bristles, are but a few of the many typical products now being processed in Barrett Impregnators. Many products heretofore considered impractical for satisfactory impregnation by other methods have been successfully handled.

The Barrett Method assures fast production, by reducing the customary hours to minutes, high penetration, with controlled impregnation, also positive expulsion of air from the articles being impregnated.

Basic units are self-contained, direct motor driven. Special arrangements and supplemental equipment also provided.

Submit your problem and samples for test and recommendations.

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Designers and Builders of Centrifugal Machinery

Balanced load!
TWIN POST MOUNTING
Means Accuracy
IN TOP-SPEED MILLING
Kent-Owens Machines do your milling right—with speed and accuracy that means greater production, fewer rejects, lower costs! The head is mounted on two cylindrical ground steel posts which carry the spindle midway between them—an exclusive Kent-Owens feature! No overhang—no cocking action. It's extra rigid . . . precise . . . dependable. Write for bulletins on wide range of hydraulic and hand-operated machines. Kent-Owens Machine Co., Toledo, Ohio.
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No. 1-14
Milling Machine
. . . 32" x 9" table
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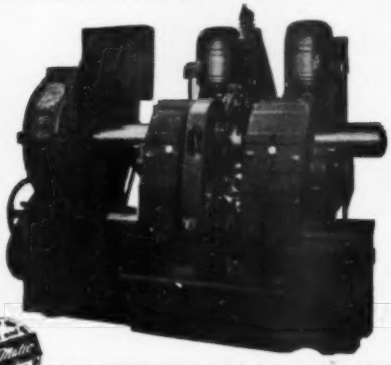
Roto 1-A Matic

HORIZONTAL PRODUCTION MILLERS

FEATURING

1 CONTINUOUS OPERATION
2 AUTOMATIC CHAIN CLAMPING
3 ROUGH & FINISH CUTTERS — EACH HEAD
4 3 TYPES — VARYING BED LENGTHS
5 LOW MAINTENANCE COST
6 INTERCHANGEABLE FIXTURES



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No. 1-A ROTO-MATIC Millers have been produced for the past 30 years in various sizes and types to do specific jobs faster and better than they have ever been done before. Because of their flexibility they have been designed to take a wide range of work with uniform satisfactory results. Engineering has made possible the milling of several work pieces at one time giving a high production of each. In all cases exacting requirements as to quality of work have been met.

Chain Clamping Fixture for rough and finish milling both ends of Control Arm Trunions to length. Interchangeable buttons make possible the milling of several sizes — Production 296 gross per hour.

Double Chain Clamping Fixture with a total of 28 stations for milling ends of Clutch Gears — Production 200 gross per hour — With this arrangement two different parts can be milled simultaneously.

Double Drum — 50 automatic holding fixtures on each drum for rough and finish milling radius on Rocker Arms — Production 1400 gross per hour.

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MANUFACTURERS OF *Machine Tools*

MILWAUKEE 14, WISCONSIN

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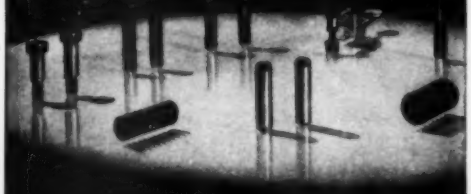

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For quick service draw on our large stock of Dowel Pins (163 Standard sizes plus oversizes), Springs, Socket Head Cap Screws, Stripper Bolts, Set Screws and Toggle Clamps.

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For Army Twill is made only from carefully selected highest quality cotton . . . Sanforized, and vat-dyed in colors that are fast to sun, water and perspiration. It takes the hardest wear and the toughest punishment of repeated washings and still looks fresh and crisp.

Take a tip from organizations that are smart about their business—boost your employee morale . . . build Company prestige . . . and effect greater savings with smarter looking, longer wearing uniforms of Reeves Army Twill.

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THE OLIVER ACE CUTTER GRINDER

When the sharpening of expensive cutters is considered, nothing is more important to you than consistency. Oliver of Adrian has made things easy for you with the ACE. The overall design of the machine makes set-ups quick and simple—places the work in full view of the operator, at the best working height to prevent fatigue. A fixed diamond compensates for wheel wear between teeth—eliminates time consuming "guesswork and redressing". Since the cutter to be sharpened is held in a fixed position and the wheel moves in to do the grinding, consistency is made easy for the operator; the weight he moves is always constant, no matter what size cutter is being ground.

You will find the ACE gives you reliable, *consistent* results on a wide variety of work.

Heavy Duty Model shown—especially designed for work in Tungsten-Carbide and other hard metals. Also available in Standard Model.

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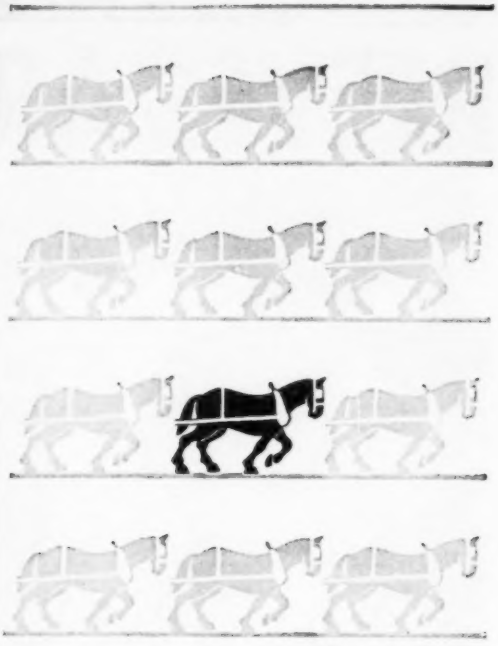

Good work-horses all... but

ONE OUT-WORKS THE OTHERS

Are you looking for a metal cleaner that will do more than just get your production clean? Investigate Parco Cleaners.

Parker's research department, with the knowledge and experience of a third of a century in the science of fine metal finishing, has formulated a line of cleaners whose benefits and advantages carry beyond the rinse-off.

Parco Cleaners remove the grease and soil—and act to condition the metal for the next step in the finishing operation. Now you can select a cleaner that helps you get economy and uniform, high-quality results with your finish.

Try a *harder-working* cleaner on your metal finishing line. Let us help you determine the Parco Cleaner that's right for you.

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Write for technical bulletin detailing properties of each Parco Cleaner.

Bonderite, Parco, Parco Lubrite—Reg. U. S. Pat. Off.

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BONDERITE—corrosion resistant paint base* PARCO COMPOUND—rust resistant*
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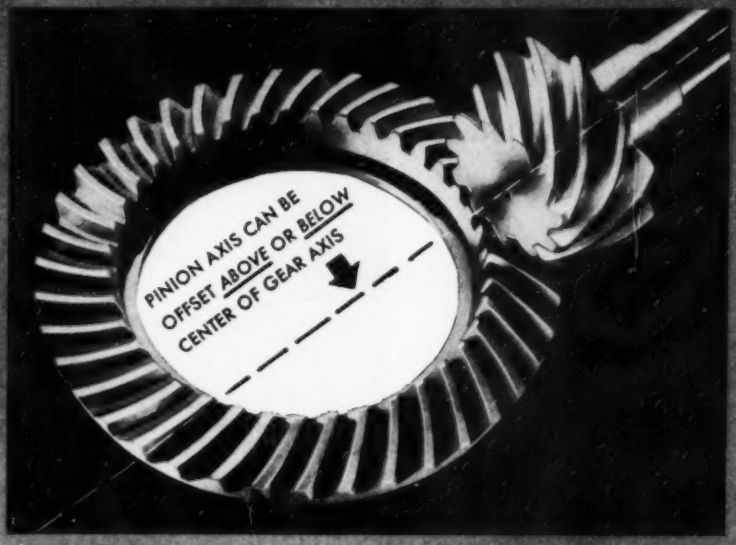
"HYPOID" GEARS *ARE STRONGER*



. . . and run very quietly and smoothly

Hypoid gears are similar to spiral-bevel gears, but have the pinion axis offset above or below the center of the gear axis.

The gear and pinion shafts of a Hypoid pair can continue past each other. This direct and compact arrangement is used to advantage in steel mill, paper mill, printing press, and many other industrial applications. Other advantages are that there is more room to place bearings on both sides of the gear and pinion, and that in some cases the lowered or raised position of the pinion allows arrangement of machinery which would not otherwise be possible.

The teeth of Hypoid Gears are similar to spiral-bevel gears, in that they are oblique and curved. They engage gradually from one end to the other, and have *continuous contact* at the pitch line—and there are always at least two pairs of teeth in contact.

Send for the "Gear Book" which contains 68 pages of highly useful information; in fact, it's almost a "treatise on gears".

Please use your Business Letterhead when writing for this Catalog.

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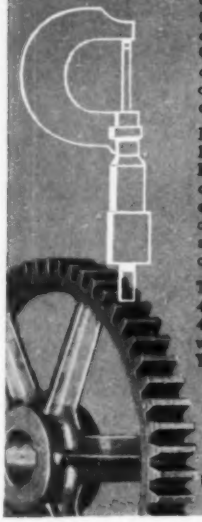
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

EARLE GEARS ARE
PRECISION CUT



When your gears are cut by Earle, close tolerances are strictly maintained, and all machined surfaces are accurately finished. Earle Gear's precision cutting and machining equipment result in smooth, quiet operation—and such is a sign of long life and satisfactory service.

Precision cutting is one phase of Earle Gear's good service. And all Earle Gears of any type made from any practical material in any diameter from inches up to 30 feet—are cut with precision. Send us whatever specifications you may have for quotation.

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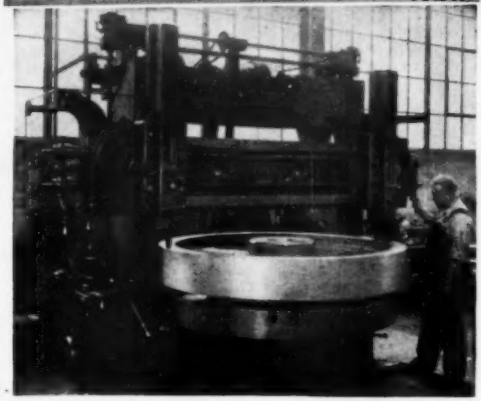
EARLE GEARS

It's good business to do business with EARLE

A Big Mouthful..



A big job, handling a gear blank this size and machining it accurately, but Stahl has the equipment to do it . . . and the men who know how to do the job well. From rough casting or forging to finished job, Stahl Gears get the painstaking attention that your gears deserve.

Modern equipment, capable of handling gears of any size, in any quantity . . . plus skilled workmen—the right combination for quality gears priced right and delivered on time. *Get a Stahl estimate first!*

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MP QUALITY GEARS CUT TO ORDER MP

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GANSCHOW CUT GEARS

SPUR—SPIRAL
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MEMBER OF AGMA

UP TO 60" PITCH DIA.
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YOUR EQUIPMENT DESERVES
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Industry has learned that it costs so little and saves so much to KNOW that with *CINCINNATI Gears, Good Gears Only*, they have the right gear for the job.

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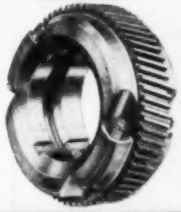
Each Cincinnati Gear contributes its share to a longer service life . . . increased production in assembly, and outstanding performance. Little wonder that so many users of gears insist on *CINCINNATI Gears, Good Gears Only.*



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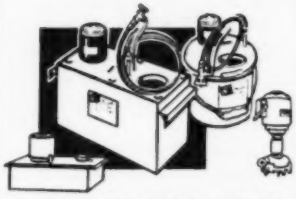
TOOL COSTS

GRAY-MILLS **NEW** PUMP and COOLANT SYSTEMS



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Tools last longer, cut better when GRAYMILLS COOLANT SYSTEMS are used. Save on tool replacements and time-per-job. Units available for grinders, drill presses, etc.

New Centrifugal Models unaffected by abrasives. Capacities 1 to 70 g.p.m. Up to 80 psi. Tanks 1 to 38 gallons.

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You can get these Special-Purpose tools

made of Abrasion-Resistant

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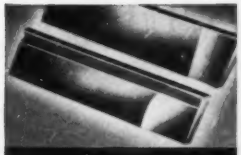
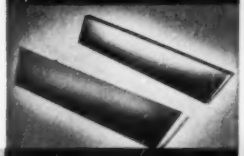
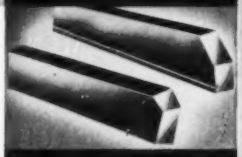


GROOVING TOOLS



CUTOFF TOOLS



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FORM TOOLS

Besides a complete line of standard tool bits, tool tips, tipped tools, and milling cutter blades, HAYNES STELLITE alloy is also available in a large variety of special tools for many different purposes. The tools illustrated at the right are only a few examples of the many forms in which this well-known alloy is supplied. Many types of milling cutters, core drills, counterbores, and similar tools are also available —and all tools are made accurately to your specifications.

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If you would like complete information on styles, sizes, and prices of HAYNES STELLITE alloy tools, write for a copy of the booklet, "HAYNES STELLITE Metal-Cutting Tools." Our staff of experienced tool engineers will gladly give assistance on your machining problems, if you will contact our nearest district office.

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Haynes Stellite Company

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Four Machine Spindles for boring, turning, facing and reaming operations on one to three ends provide greater and quicker production than any other "chucker" in the machine tool industry.

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Write for further interesting details.

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MACHINE COMPANY
KENSINGTON, CONNECTICUT, U.S.A.

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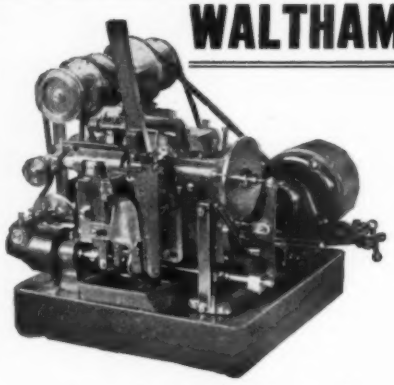

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Magazine-Fed Pinion Machines—fully automatic
Gear Cutting Machines—single and multiple cut types

Precision and Economy in Mass Production of Small Parts

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Write for illustrated literature giving detailed description and specifications.

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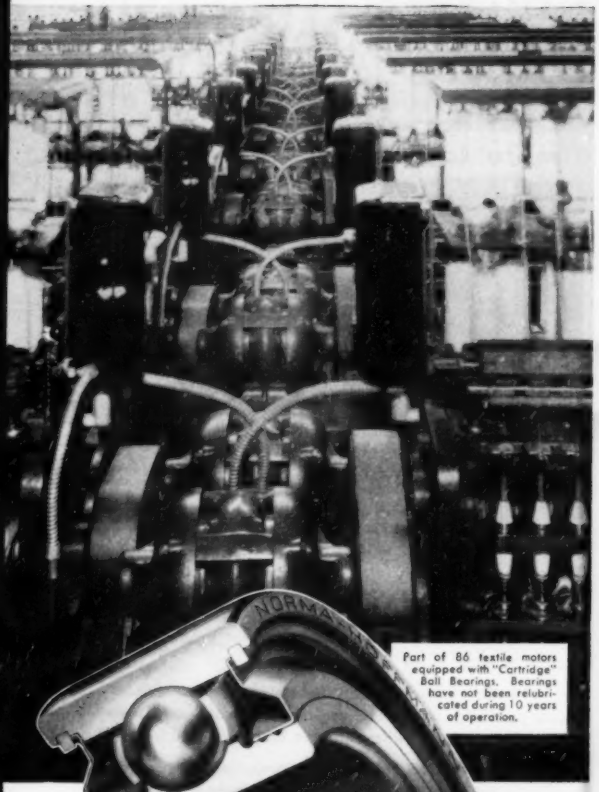
CASE HISTORY #819

646 Motors Operate 8 to 10 Years Without Relubrication or Bearing Failures ...and they're still going strong



Part of 86 textile motors equipped with "Cartridge" Ball Bearings. Bearings have not been relubricated during 10 years of operation.

Norma-Hoffmann

Patented "Cartridge" Bearings increase the "Life-Span" of Equipment

Records prove that Norma-Hoffmann "Cartridge" ball bearings give continuous performance in hundreds of applications without failure.

For example — 646 motors in 5 textile mills have been operating practically continuously for 8 to 10 years without relubrication. On inspection of many of the motors, the bearings showed no appreciable wear and the original grease was in good condition for many more years of operation.

Made to double-row width, Norma-Hoffmann "Cartridge" bearings have 100% more grease capacity than conventional width sealed bearings. The highly efficient seals keep dirt out, grease in. Factory-packed with Norma-Hoffmann's specially compounded "stability-tested" grease . . . grease that is highly resistant to oxidation and breakdown . . . assures dependable operation for long periods without regreasing.

Investigate the "Cartridge" ball bearing for your products whether they be motors, machine tools, pumps or other machinery. Our engineers are always available for consultation about your bearing applications. Write for their services.

NORMA-HOFFMANN *Precision* **BEARINGS**

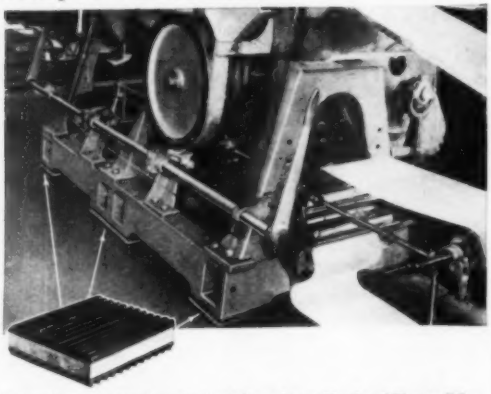
BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONNECTICUT

Field Offices: **New York • Chicago • Cleveland • Detroit • Pittsburgh • Cincinnati • Los Angeles • San Francisco • Dallas • Seattle • Phoenix**

LOW COST VIBRATION and NOISE CONTROL

No Bolting...No Cementing... Simple to Install



This printing press is mounted directly on Korfund Elasto-Rib —without cementing or bolting. It is one of a battery of 21 high speed color presses, all mounted in the same way, in the plant of one of the world's largest producers of quality labels.

Vibration no longer interferes with the fine adjustments necessary for perfect register, and noise has been reduced to the point where it is no longer a disturbance.

Elasto-Rib effectively stops transmission of vibration and noise because it utilizes the elastic and damping properties of both cork and rubber. Elasto-Rib has a core of high-grade cork plate bonded between two layers of deep grooved, oil resistant synthetic rubber.

It is fast and easy to install! For most machine applications, no bolts, lag screws or cement are needed, and no drilling or other preparation of the floor is required. Simply place the Elasto-Rib under the equipment to be isolated, and the job is done! It can be cemented in place, if necessary, with a quick-acting high strength cement, which we supply.

Elasto-Rib is 1" thick, stocked in sheets up to 24x36", and is sawed or cut to size as needed. It has a loading range of 750 to 5,000 lbs. per square foot. A good average loading is 20 lbs. per square inch (3,000 lbs. per square foot), which makes it very inexpensive.

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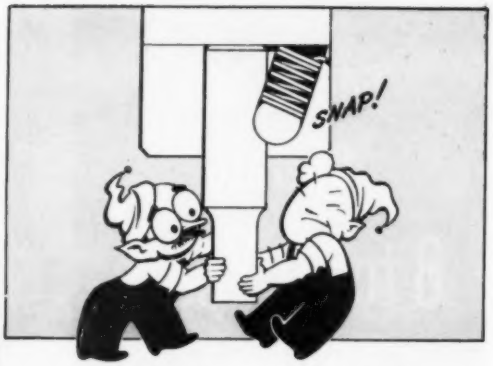

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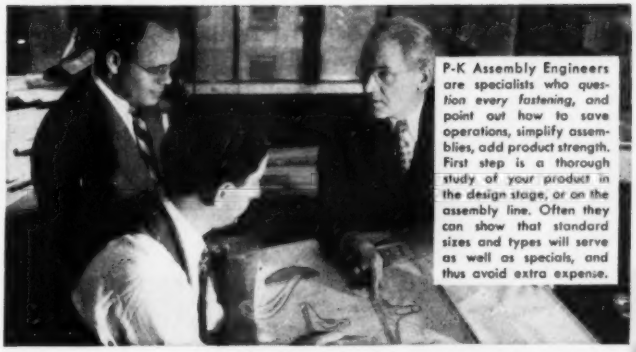

P-K Assembly Engineers are specialists who question every fastening, and point out how to save operations, simplify assemblies, add product strength. First step is a thorough study of your product in the design stage, or on the assembly line. Often they can show that standard sizes and types will serve as well as specials, and thus avoid extra expense.

When required, tests of recommended fastenings are made in Parker-Kalon's Engineering Service Laboratory.

All recommendations are combined in a complete report furnished as a guide for assembly operations.

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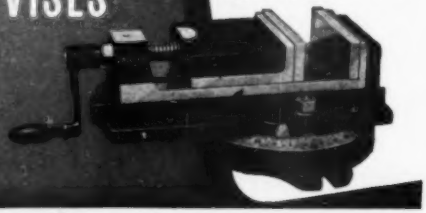

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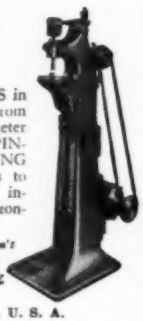

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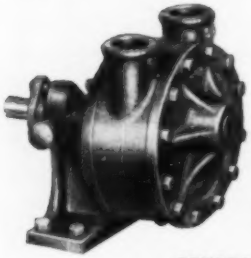

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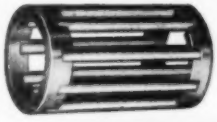

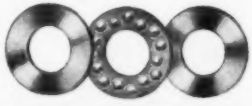

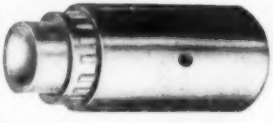

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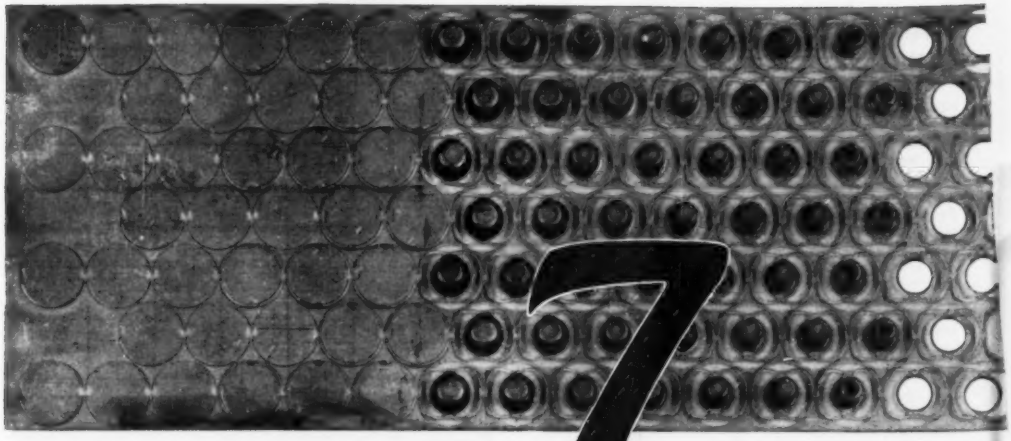
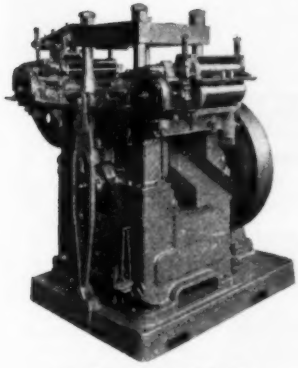


a Dieing Machine gives you → 7, making 50,400 per hour



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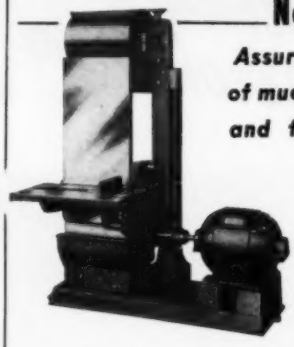

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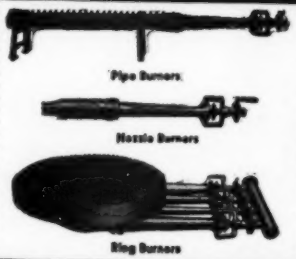

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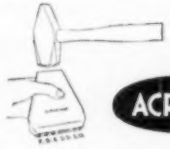

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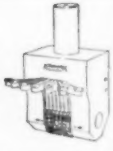

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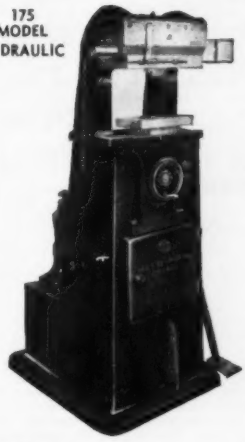

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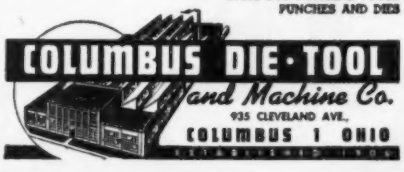

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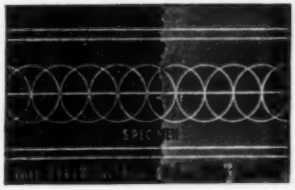

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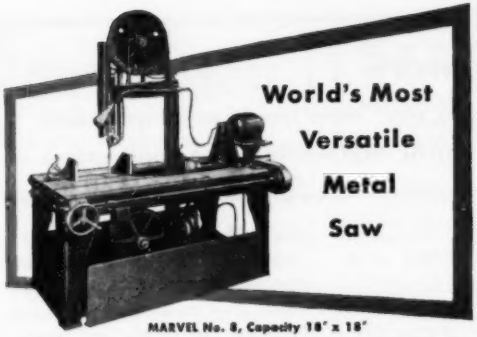

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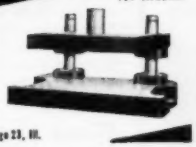

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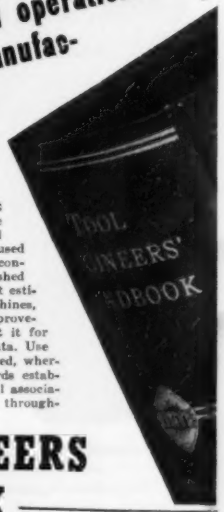

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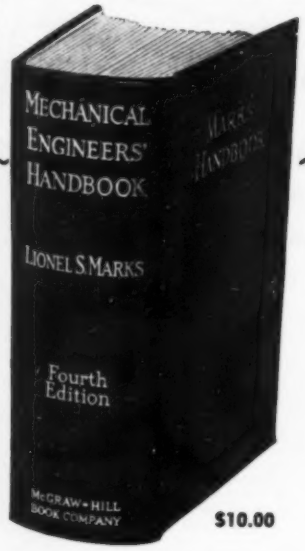

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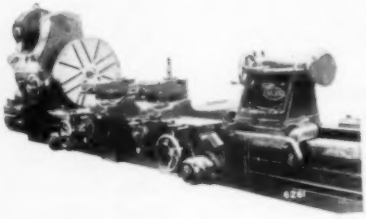

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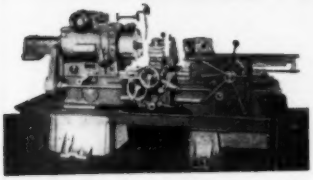

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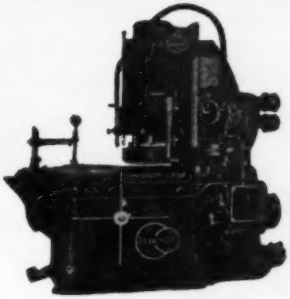
16"x6' South Bend Enclosed Head, Motor driven. Taper Attachment, Chucks, Collets & Quick Acting Collet Chuck.
14½"x6' South Bend Enclosed Head, Motor Driven. Taper Attachment, Chucks, Turret Toolpost Threading Dial, Ram Type Turret Attachment, Collets & Collet Chuck.
14"x8' Reed-Prentice Eight Speed Selective Geared Head, Q.C.G. Motor driven w/220/440 volts moto & controls. Has Taper Att. chuck, faceplates, steady rest, cabinet legs. max. centers —48". Completely rebuilt. Immediate shipment.
10"x20" Monarch Model #EE. Late Type.

BETTS 100" Special Vertical Boring and Turning Mill. 1944 Machine. 2 Plain Heads. Complete electrical equipment. Excellent condition. Immediate delivery.



Blanchard #16 Motor Driven Vertical Rotary Surface Grinder. 26" Chuck with power down feed to head. Built-in coolant system.

GRINDING MACHINES

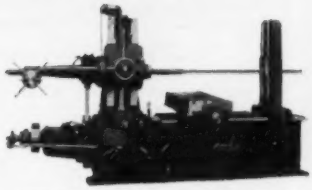
Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.
Heald #22 & #25, 12" & 16" Horizontal Rotary Surface Grinders. Motor driven.
Cincinnati 'Monoset' Model #OE Cutter & Tool Grinder. Motor driven. With motors & controls. Set of collets, taper & cylindrical and equipment.
Thompson 6x18 Hydraulic Horiz. Surface. Wet & dry work. 220/440 motor driven. Auto, downfeed to head. Motor driven exhauster unit.
Gallmeyer & Livingston #4 Motor Driven Universal Tool & Cutter Grinder. W/Internal Attach. & Thrd. Chaser & Equipment. Motor driven coolant.
Norton 6x18 Vertical Rotary Automatic Surface Grinders. 220/440 volts motors. Excello Spindles. Hydraulic Table feeds. Three Available with immediate delivery. Also 6x18 Horizontal.

AUTOMATICS

#OG & #00 Brown & Sharpe Automatic.
#2G Brown & Sharpe Standard Speed. 220/440 volts motor & push button controls. Complete coolant, turret tooling, collet & collet chuck, toolblocks. FOUR AVAILABLE—FROM STOCK.
#2 Brown & Sharpe Automatic Turner drive 220/440 volts motor. With Stock stands, collet, toolposts, coolant system, change gears. FOUR AVAILABLE.
Cleveland Model "A" 3¾" capacity Single Spindle Motor Driven Automatic. Has lot of tooling, collets, motors and switches & coolant system. 1943.

PUNCH PRESSES

O.B.I. Johnsen (NEW) all sizes, geared & plain.
O.B.I. Federal #3, 26 tons cap. motor dr.
O.B.I. Toledo #5, 44 tons cap. motor dr.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
O.B.I. Michigan, 36 tons cap. Wide ram & bed.
Geared S.S.S.A. Bliss #305 Motor driven.
Wheel Press, Niles, B & Pond Horiz. Hydraulic. 200 tons cap. 48" between strain bars.
Stamping, Ferracute #86 Wide Frame, 61½" between housings. 13¾" stroke. Motor driven.
Transfer, Nilson 56 tons S.S. Dble. Crank 3-Die.
BLISS—Consolidated #77 Open Back Gap Frame Back Geared, 160 Tons Cap. M.D.



Lucas #31, 3" Bar, Horiz. Boring Mill. #5 Morse taper. Motorized, 220/440 volts. All geared speeds and feeds.

SHAPERS

Shaper—Columbia 32" B.G. Crank motorized Power downfeed to head.
Shaper—Logan 7" Horizontal. NEW.
Shaper—Machinery Sales 16", motorized.
Shaper—Smith & Mills 16" motorized.
Shaper—Smith & Mills 16" Universal.
Shaper—Gould & Eberhardt 16", motorized.
Shaper—Gould & Eberhardt 18" B.G. Crank.
Shaper—American 24" crank, motorized.

MILLING MACHINES

Nichols Head, Late Type, M.D. (six)
Hardinge B.B. Vertical, Bench.
Becker #5C Vertical, Cone Dr.
Cincinnati #3, #4, #5 Pl. Horiz.
Brown & Sharpe #12 Production. 18" Autom.
Brown & Sharpe #12 Production. 24" Autom.
Brown & Sharpe #0, 1, 1Y Horizontal.
Kempsmith #1, #2 Plain Horiz.
Cincinnati 18" Mfg. Plain.
Milwaukee #2K Vertical, M. Dr. Dial Type.
Milwaukee #3K Vertical, M. Dr. Dial Type.
Milwaukee #1½ Dbl. Overarm, Horiz.
Milwaukee #2B Dbl. Overarm, Horiz.
Milwaukee #3B Plain Horizontal.
Pratt & Whitney #2 Duplex, Motorized.
#3 Dial Type, H.S. Cincinnati Vertical Mill. Power Rapid Traverse, speeds up to 1300 r.p.m. Range—34"x16"x16" Head has 6" vertical with four stop indicator. Serial #4A3V1L-61. Timken Bearing. 10 h.p. motor drive in base. Two available.

UNIVERSAL MILLING MACHINES

LeBlond #4 Hog Duty. 40x10x14 M. Dr.
Ames Bench, 12" x 3" x 7½" W/Index Hd.
Index #40H, 16"x8½"x16"
B & S #2, 20"x5"x17½".
B & S #1½, 20"x7"x18".
Bridgeport, 20" x 9" x 16" Turret Type.
Garvin #2MU, 24"x8"x18".
K & T "Milwaukee" #2, 28"x10"x17".
Kempsmith #2, 28"x8½"x18"
Cincinnati #2, 28"x10"x18".
Cincinnati #2M, 28"x10"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S, 34"x12"x20".
Some w/index heads & equipment.

RADIAL DRILLS

Cinci-Bickford 6' Arm, 15" Col. 24 Speeds.
Cinci-Bickford 5' Arm, 13" Col. 24 speeds.
Fosdick 5' Arm, 14" Col. Hvy. Duty, Motorized.
American 4' Arm, 11" Col. Motor on arm.
Cinci-Bickford 3' Arm, 9" Col. 12 Speeds.

EASTERN OFFERS FROM STOCK

AUTOMATICS

No. 4D Potter & Johnston, m.d., latest (4)
8 spindle 1⅝" Cone, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Foy Flanders Type, m.d.
20x25" Jones & Lamson, m.d., latest
4 spindle ⅞" Model R-4 Acme Gridley, m.d.
4 spindle 2¼" Cleveland Model "K", m.d.
2¼" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4¼" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¼" Cleveland Model A, m.d.

BOLT MACHINES

2" Double Spindle Landis Bolt Threading Machine, m.d.
Victor Nut Facing Machine, m.d., latest
⅝" Style R Economy Automatic Threading Machine, belt drive
3 spindle 1¼" Acme Bolt Threading Machine, new

HORIZONTAL BORING MILLS

No. 0 Giddings & Lewis, m.d., 3½" bar
2½" Cleveland, m.d.
3½" Cincinnati-Gilbert Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 31 Lucas, 3" bar, m.d.
No. 33 Lucas, 4½" bar, m.d.
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn, H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret head, 1 swivel head
48" Colburn H.D., m.d., 1 turret, 1 swivel head
48" Putnam, H.D., m.d., 2 swivel heads
54" Bullard Spiral Drive, m.d., with side head
54" Colburn, m.d., 1 turret, 1 swivel head
72" King, m.d., 2 swivel heads, 1 side head, latest
84" Niles H.D., m.d., 2 swivel heads, p.r.t.
100" Niles Heavy, m.d., 2 swivel heads, p.r.t.
100" Niles Extra Heavy, m.d., p.r.t., late
120" Niles Heavy, m.d., 2 swivel heads, p.r.t.

RADIAL DRILLS

3' American Sensitive, cone
3'10" Fosdick, gear box
4' American Sensitive, md. on arm
4'-11" col. Morris "Mor-Speed," m.d. on arm
4'-12" Fosdick, gear box
4'-13" American, gear box
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col., gear box
5'-13" Cincinnati-Bickford, m.d.
5' Cincinnati-Bickford Full Universal, gear box
5' Cincinnati-Bickford Plain Hole Driller, m.d. on arm
5' Prentice, Plain, m.d.
6'-15" col. American Hole Wizard, m.d. on arm, 2' column extension
6'-15" Carlton, gear box, inclosed head
6'-15" Cincinnati-Bickford, with 7' arm, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-17" Drosset, gear box, m.d.
8'-18" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

20" Barnes All Geared, m.d., tapper
21" Cincinnati-Bickford, m.d., tapper
24" Cincinnati-Bickford, m.d.
30" Rich, H.D., m.d
H3 Barnes Hydram, md.
D4 Colburn H.D., m.d
D6 Colburn H.D., m.d
No. 25 Foote-Burt, md
No 36MO Baker, H.D., m.d.
No. 210 Barnes All Geared Self-Oiling Drill, m.d.
No. 217 Baker H.D., s.p.d.

GEAR SHAPERS

No 6 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61 Fellows, belted md.
No 61A Fellows, m.d., latest type
No 64S Fellows, m.d.
No. 615A Fellows, m.d.
No 645 Fellows, belt drive
No. 72 Fellows, m.d., latest
No. 7125A Fellows, m.d., latest
No 75 Fellows, m.d.

BROACHING MACHINES

No. 4 Oil Gear Hydraulic, m.d., 64" stroke
75 H.P. LaPointe Horizontal Hydraulic, 150" stroke, 37½ tons cap.
Cincinnati Mill Broach, m.d., 10" spindle, new

BALL BEARING DRILLS

Model D 1100 B Walker-Turner Beach Type, 20" size, brand new
2 spindle 20" Canedy-Otto, m.d., No. 4 Taper
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 2—12" Foote-Burt Single Spindle, m.d.
No. 4 Fosdick, 8" overhang, belted m.d., No. 2 Taper
No. 4BM—24" Fosdick, m.d., latest
No 5M—16" Fosdick, m.d.
2 spindle No. 3 Avey, belted m.d., p.t.
3 spindle No. ½ Avey, Heavy, direct m.d., latest
4 spindle No. 2 Avey, belted m.d.
6 spindle Leland & Gifford, No. 2 Taper, m.d. on each spindle
6 spindle 2B Edlund, md., No. 2 Taper
6 spindle No. 3 Avey, belted m.d.

HORIZONTAL DRILLS

Morris Horizontal Mor-Speed, m.d.
No. ½Bx36" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. 1Bx56" P. & W. Deep Hole Drill, m.d., latest
No. ½Bx50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. ½Bx50" P. & W. Chambering Machine, m.d., latest
No. 1Bx50" P. & W. Deep Hole Drill, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d., latest
No 1 P. & W. 2 spindle Deep Hole Drill, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest

We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Let us quote on your requirements.

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ALL PRICES DRASTICALLY REDUCED! !

All Late Type

≅3B DeVlieg Jig Mill, 3" bar, 46 machine
≅42 Lucas Boring Mill, 4" bar, '42 new
≅28/60 Vertical Cincinnati Hydrotel, '44
500 Ton Toggle, 108x60 bed area, Toledo
200 Ton 80x40 bed, Toledo
Bliss Press, 105x48", 300 Ton
5" Bar Floor type boring Mill, Liberty, 1941
5" Bar Table type boring Mill, Sellers, Late
≅12 Brown & Sharpe Univ. Grinder 48½"x 12"

SPOT WELDERS & BRAKES

All sizes spot welders, air operated. 25% off list price.

Hand Brakes all sizes up to 10'.

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PAULS MACHINERY COMPANY
5111 Vermont Ave. — Detroit 8, Mich.
Phone TYLER 7-6300

GRINDERS

6x18" Cin. Hydr. (Film.) MD.
6x18" Norton Plain Hydr., MD.
10x18" Norton, Model ER. Plain, MD.
12x36" Cincinnati Univ., MD.
5B. Bryant Internal Semi-Auto., MD.
12x48" Thompson, Chuck., MD.
Sellers Tool Grinder, 2x1½", MD.

MISCELLANEOUS

1M & 2M. Cincinnati, Vert., MD.
Millers, Hand, 1M Kent-Owens, MD. (6)
Miller, Hyd. ≅2-20 Kent-Owens, 230 V.DC.
Hydr. Press 250-Ton HPM. Upstr. 6", pump. MD.
Pumps, Vacuum Kinney, VSD8-811, MD.
Vaughn MotoBloc, ≅10 Sql. Deck, 230 V. DC. (3)

GALBREATH MACHINERY CO.
Empire Building, PITTSBURGH, PA.

AUTOMATICS—Natl. Acme 1⅝", four spindle. Bargain (2)
BRAKE—(Press) Verson 10'x½" (1942)
HYDROHONER—Micromatic Model #4H (1943)
LATHE—Bamford-Chase Tool Room, 14"x6' Taper. Late Bridgeford, Engine, g. head, 32"x21' centers.
MILLER—Plain K. & T. #4K, Late.
PLANER—Cleveland Openside 60"x60"x20', Late. Niles Bement Pond 40"x48"x26', 4 heads.
PRESSES—Bliss #8, 125 ton, Late.
Clearing—200 Ton (1943)
Bliss #310—440 Ton
(1) Lake Erie, 750 ton, Hydraulic, Bed 72"x140" single or dble action, Late.
ROLLS—Bending 30'x¾" Pyr., 10'x½" Pyr., 11'x ¼" Initial, 16'x1¾" Pyr.
WELDERS—(New) Sterling 30 KVA, Bargain.

KINGS COUNTY MACHINERY EXCHANGE
408 Atlantic Ave., Brooklyn 17, N. Y.
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Hendey 14"x30" geared head Lathe.
Lodge & Shipley 16"x30" geared head Lathe.
Nos. 1 & 3 W & S Turret Lathes.

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Metal Forming and Bonding Machine
#206-F Toledo 155 Ton D.C. Press, 3" Stroke, 20" x 110" Bed Area
Roller Type Slab Miller, 22" Slab capacity
12 Spindle Moline Automatic Drilling Machine
3 Spindle Moline Model 7-D Cylinder Borw
1-A W&S Universal Turret Lathe
36" x 14' Schumacher & Boye Engine Lathe
Libby 26" x 4½" Spindle Turret Lathe
20" Stockbridge Shaper
Lees-Bradner CT 30" Thread Millers
Crankshaft Grinder
Foote-Burt 4 Spindle Drill #2 M.T.
Acme Gridley 4 Sp—Model G—1⅝" Auto.

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SPECIAL OFFERING

#4-R GISHOLT SADDLE TYPE TURRET LATHE, SERIAL NO. 2914-37, 9" HOLE IN SPINDLE, Mfg. approx. 1942.
PRICE $4,500.00

#3-R GISHOLT SADDLE TYPE TURRET LATHE, 5" HOLE IN SPINDLE, 1942 MACHINE.
PRICE $2,500.00

Both Machines in Excellent Condition

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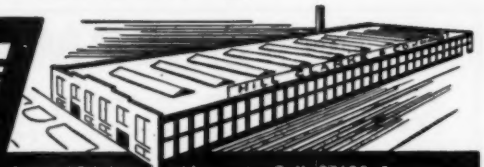

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AUTOMATICS
1½" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1½" (1942)
No. 6 Brown & Sharpe, M.D.
No. 49 New Britain, 4 Spdl. Chucker
Model A 2½" Cleveland (1943)
Model A 3¼" Cleveland (1942)

DRILLS
No. 150 Baker, tapping (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 1-LMS Leland-Gifford's (1942)
No. 2-LMS Leland-Gifford's (1942)
No. 4BL Natco 36 Spdl. (1943)
6'-17" Col. Fosdick Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
12" Gleason Bevel Gear Cutter
37" Gleason Bevel Gear Planer
72" Cincinnati Gear Cutter

BORING MACHINES
No. 31 Lucas, 3" bar, M.D.
No. 48-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
42" Bullard New Era, M.D.
42" Colburn M.D.
60" Colburn, M.D.
72" Niles Extra Heavy
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders ranging from 6"x18" to 24"x240"
No. 5—8"x24" Covel Hydr. Surf. (1941)
No. 36-A Hanchett Rotary Surface (1942)
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
Bryant Internal Grinders (1942)

LATHES
16"x54" centers LeBlond (1941)
16"x80" centers Pratt & Whitney, Model B
18"x6' American, Grd. Head, M.D.
19"x39" gap x 10' LeBlond
27"x18' Lodge & Shipley Gear Head, M.D.
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼" Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

MILLING MACHINES
No. 2 SP Van Norman Plain (1942)
No. 4 Cincinnati Hi-Spd. Plain Dial Type (1943)
No. 2 H Milwaukee Vertical (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cin. Mfg. (1940)
No. 2—18" Sundstrand-Electromil (1942)
No. M-24 Milwaukee Simplex (1942)
38"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex
No. 45-48 Cinn. Hyd. Duplex
No. 56-72 Cincinnati Hydromatic
4½"x12" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller, 4 Hds.
No. 10 Ingersoll 72"x6' Travelling Col. Face Millers (1942)

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners
Baush Radial Tapper (1942)

PLANERS
36"x36"x12' Cincinnati
36"x36"x18' Gray, Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

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20"x96" NORTON Plain Cylindrical Grinder with all AC motors. *Excellent condition*

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National Bent Shank Nut Tappers Battery of ⅜" to 1" Machines.

Waterbury-Farrel Fdry. ⅜" and 1" D.S. S.D. Cold Headers, also Thread Rollers.

Fisher 5" Bar, Floor Type Boring Mill. New in 1942.

Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.

Bliss Presses in all sizes up to 1,000 ton capacity.

Wire Working Machinery.

National Machinery Exchange
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FOR SALE
BULLARD
42" BORING MILL V. T. L.

Ser. #20412—New in 1942
Motor 25 HP—3 ph—220/440—60 cy.

$13,750.00

Condition Excellent

ZAKROFF MACHINERY CO.
249 N. Third St., Phila., 6, Penna.
Ma-7-1540

No. 25T G. & L., 2½" table Hor. Mill, 1942
4" Univ. Table Mill, 60" vert., 96" hor., 1943
36" & 42" King Side Hd. Vert. Mills, '43
Nos. 1A & 2 W. & S. Turrets, bar & chuck
4'11" col. Bick. radial, '47; #262 Barnes drill
3' 11" Fosdick & 3' 9" Amer. Radials, '43
28/60 Cinci. Hydrotel Vert. Miller, 1 spin.
360° Cinci. 4 Spin. Profiler, 1942
Nos. 3 & 2MH Cinci. Pl. Dial Millers, late
Nos. 3K & 3H K. & T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicator, late
Nos. 9J Gorton Duplicator & Vert. Miller (2)
Bridgeport Vert. Miller, slotting (3)
12"x24" G. & L. No. 45 Surface Grinder, '42
No. 70A Heald Internal Grinder, 1942
Gear Cutter, No. 13 B. & S., spur & bevel

BENNETT MACHINERY CO.
30 Church St., New York 7, N. Y.

LATE TYPE MACHINES

Bullard 12" 6-spdl. MULT-AU-MATICS (2)
10"x48" Norton "C" Plain Grinder
#16-Y-28 Bryant Internal Grinder
#725 Fellows Gear Shaper
#3MS Cincinnati Plain Miller
#5H Kearney & Trecker Plain Miller
13"x30" Pratt & Whitney Model "B" Lathes

HAZARD BROWNELL MACHINE TOOLS INC.
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OIL MIST PRECIPITRONS
35 Westinghouse Precipitron Machine Tool oil mist eliminators type 313 capacity 600 CFM. War Surplus offered at a fraction of original cost.

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LIBERTY PLANERS, INC.
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MACHINERY FOR SALE—$700.00

1—Centrifugal Blower Assembly complete with 120 HP Continental Engine Model 33R, 80" Buffalo Forge Centrifugal Blower and Steel Platform.

CORNELL AERONAUTICAL LABORATORY, INC.
4455 GENESEE ST. BUFFALO 21, N. Y.

Bor. Mills, Hor. 3" G & L, 4½" N.B.P.
Bor. Mills, Vert., 24"-36"-42"-60"-72".
Drills, Radial, 3'-4'-5'-6' Cin.-Bick.
Grinder, Surface, #2 Diamond, Mag. chuck.
Lathes, Turret, 3A W. & S., and 24" Gisholt.
Millers, Plain No. 3, 4, & 5-B Cincinnati.
Millers, Vert. No. 3 & 4 Cincinnati.
Shaper, Draw Cut, 36" Morton.
Swager, #3 Etna, 1½" tubing.

West Penn Machinery Company
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LATE TYPE MACHINE TOOLS

AUTOMATICS

6" RPA-8 Acme-Gridley Chucker. 1941.
16" Bullard Mult-Au-Matic, 6 spdl. 41.
1⅝" Greenlee, 6 spindle. 1942.
9/16" RA-6 Acme-Gridley. 1942.

BORING MACHINES

No. 42 Lucas Horizontal. 1940.
No. 54 Excello Double End. 1940.
No. 49 Excello Double End. 1942.

DRILLS, HEAVY DUTY

No. 121 & 217 Baker. 1941.
W-6 Baush Hyd. Mult. Spdl. 1943.
No. 40 Fox Multiple Spdl. 1944.

GEAR EQUIPMENT

3" & 12" Gleason Generator. 1941.
12" Gleason Rougher. 1943.
No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL-3 Red Ring Shaver. 1942
No. 615A & 61A Fellows Shapers. 1943.
No. 7125A & 712 Fellows Shaper. 1943.
No. 18 Fellows Finisher. Late.
Vinco Spline & Gear Grinder. 1942.

GRINDERS, CYLINDRICAL

16"x36" Cincinnati Plain. 1942.
12"x48" Cincinnati Univ. 1943.
10"x72" Landis Plain. 1942.
10"x18" Norton Plain. 1942.

GRINDERS, INTERNAL

No. 74 Heald Ext. Bridge. 1941.
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 16A22 Bryant. Latest.

GRINDERS, SURFACE

14"x36" P&W Vertical. 1938.
No. 22 & 25A Heald Rotary. 1943.
No. 2B Reid. 1942.

LATHES, ENGINE

32"-45"x22' Axelson. 1942.
28"x28' Bertram. 1942.
24"x168" Sidney. 1942.
18"x54" Lodge & Shipley. 1943.
18"x48" Bradford. 1942.
14"x54" Reed Prentice. 1942.

LATHES, PRODUCTION

Gisholt "Simplimatic". 1943.
No. 3A L&S "Duomatic". 1943.
No. 2FU Foster "Fastermatic". 1943.
20"x97¾" LeBlond Rapid Prod. 1941.
8"x108" Lo-Swing Semi-Auto. 1942.
Model 8, 10 & 12 Sundstrand. 1942.
14"x42" Monarch "Magna-Matic". 1941.

LATHES, TURRET

36" Bullard Vertical. 1943.
No. 2A & 3A Warner & Swasey. 1943.
No. 1 & 8½"x24" Acme Univ. 1943.
No. 3L Gisholt. 1941.
No. 2, 3, 4 & 5 Warner & Swasey 1943.
No. 2, 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN

No. 5 Cincinnati. 1943.
No. 4H & 4K Milwaukee. 1943.
No. 3 Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION

BL-2420 P&W "Keller", 3 sp. 1942.
BL-2416 P&W "Keller", 1 sp. 1943.
BG-1 Keller, single spdl.
No. 1848 Kearney & Trecker. 1942.
No. 1248 Kearney & Trecker. 1942.
No. 1-18 & 2-18 Cincinnati 1942.

MILLS, THREAD

6"x60" Pratt & Whitney. Latest.
12"x54" Lees Bradner. 1943.
8"x16" Hanson Whitney. Late.

MILLS, UNIVERSAL

No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU & 26SU Van Norman. 1942.

MILLS, VERTICAL

No. 3H & 3K Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1941.
No. 2K Milwaukee 1942.

PRESSES

No. 40-5½ Minster. 1946.
No. 8R Rockford. 1946.
100 Ton Hannifin, Hyd. 1942.
45 Ton Reliance. 1942.

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AUTOMATICS

Brown & Sharpe #00G, H.S., #4, #6
Conomatic 8 sp. 1⅞" cap.
New Britain Gridley 6I—6 Sp. 2¼"

BORING MILLS

Giddings & Lewis #9, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #31 horiz.

DRILLS AND RADIALS

Amer. 4'-13" col. Radial, Canedy-Otto 3'-9" col.
Carlton 8'-19" col., Foote-Burt 6 Sp.
Cinci-Bickford Super-Service 21", 24"
Natco Model E-5 Multi-Spindle, 14 spindles
Sibley 24—28", Allen 6 Sp., Excelsior 21"

ENGRAVERS

Gorton #3U, 3Z, 3L; Deckel GI, GIF
Gorton Cutter Grinders 575-2, 265-5

GEAR EQUIPMENT

Fellows #72, 725 High Speed, Mikron Gear Hobber
Michigan, Gleason, Fellows Checkers

GRINDERS—Miscellaneous

Brown & Sharpe #5 cyl., 3"x18", Black Diamond
Brown & Sharpe #1, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic, 12"x36", 12x48" Univ.
Covel #91A Univ. Tool & Cutter
Gardner #22S, 30" disc, Heald #1 Tool, K. O. Lee Tool & Cutter, Hammond #4 Carbide
Landis #4M Cyl. 4x12", Landis #6 Thread, Centerless
Norton #2 Tool & Cutter, Porter Cable Belt WG8
Norton Cyl. 6x18" Type C, 6x30" Type C
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Greenby Int.

GRINDERS—Surface

Abrasive #1½" Wet, #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #18—42" Chuck
Brown & Sharpe #2
G. & L. #18, 6x18" Hand Feed, #25, #35 Hyd.
Hanchett #380, 13x48", Mattison 14x16x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x36" Vert.
Reid #2A P.F., #2C Pape & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES

Bradford 16"x6', Hardinge Precision 9", cabinet
Hendey G. H. 16x30 with relieving att.
LeBlond Regal 10"x3½', 15x30', 19x48", 21x60"
Lodge & Shipley 16x18" T.A., LeBlond HD 16x33"
Monarch 10"x20' EE, 16x78" T.A., 12x30' CKK
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½', 13x36", 10" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

Lathes—Turret

Acme #6W Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck
Jones & Lamson #8A Univ., Hardinge ESM
Oster #601 Rapiduction, Morey #3, 1½" cap.
Warner & Swasey #3, #4, #4A—8" Bar Cap.

MILLS—Plain & Universal

Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2MH Univ.
Milwaukee #2HL, 2H, Plain, #2HL, 2H, 3H Univ.
Van Norman #12, 20, 22L, 36

MILLS—Vertical—JIG BORERS

Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4 Dial Type, Jackson
Fosdick Jig Borer #42 Like New 1947
Gorton #8D, 9I Plain, #9½D Duplicator
Kearney & Trecker #5H, 3H Hight Speed
P&W 1½B Jig Borer, Sip Jig Borer #MP-5
Moore Jig Grinder, Vernon Jig borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production

Brown & Sharpe #000, 12, 2I
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM I, Keat Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES

Bliss #8 Dbl. Crank, Bed 42x100", 250 Ton
Bliss #675, 645B, 650 Hi-Production, 304A, 305A
Bliss #20, 21 O.B.I., #4½ Double Action Cam
Bliss #50 OB, Gap Frame #62, 62A, 162
Henry & Wright 25, 60, 75 Ton Dieing; Reliance 45, 45 ton O.B.I.
Reliance 45 ton O.B.I.
Thomas 7A, 80 Ton O.B.I., Gen. Flex Elec. Screw
V. & O. #25B O.B.I., #102 Reducing, Z & H 30 Ton

MISCELLANEOUS

BAND SAW: DoAll #ML, Tannewitz #36M
BENDING ROLL: Buffalo #2, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
HACKSAW: Marvel #6A Automatic, #6 #4B
HAMMER: Nil.s Bement Pond 2500 lbs. steam
HONER: Micromatic #H-1 Hydrohoner, Sunnen
INJECTION MOLDER: Reed-Prentice #10D6, 6 ounce, 8 ounce heating cylinder
IRONWORKER: Buffalo 25U x 20 Univ.
KEYSEATER: Mitts & Merrill, Baker Davis
PRESS BRAKE: #253, #335 Chicago
ROUTER: Onsrud #W240, #55 Oliver
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #30 with Dies
WELDERS SPOT & SEAM: Sciaky, Thompson, Taylor Winfield
WRAPPING ROLL: Buffalo #½

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen	Stroke	Opening
500 Ton	Lake Erie	35x36"	30"	66"
600	Bald. S'thw'k	76x59"	22"	36"
500 D.A.	H.P.M.	36x36"	24"	30"
1000	French Oil	53x42"	20"	50"
300	Brand New Watson Stillman Hobbing Press			
375 D.A.	Elmes	84x44"	12"	42"
350	Verson	40x40	36"	72"
50	Dennison	22x20	18	23
150	Southwark	34x30	30 2' to 4'	

UP MOVING RAM PRESSES

50 & 100 Ton Stokes Molding Presses & Pumps
300 Ton Dunning & Boschert Molding Press
500, 800 Ton Waterbury-Farrel 3 & 4 Rod Presses
300 Ton Watson Stillman Press, 24x20" Platens
400 & 500 Ton Shaft Straighteners—Self Contained

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MSNA MEMBER

INTERNAL GRINDERS

No. 72A3 Heald Sizematic, cross sliding head
No. 72A3 Heald Sizematic, plain head
No. 72A3 Heald Sizematic centerless
Nos. 72A3 & 72A5 Heald plain
No. 72A5 Heald, extended bridge
Nos. 72A3 & 72A5 Heald, cross sliding head
No. 74 Heald plain
Nos. 75 & 75A Heald plain
No. 16A16 Bryant
No. 16CP16 Bryant
No. 16-28 Bryant
No. 16F28 Bryant
No. 16-36 Bryant
No. 24-36 Bryant
Model MHI Sav-Way hydraulic
No. IC Greaby bench
No. 60 Heald cylinder

SURFACE GRINDERS

16", No. 10 Blanchard rotary
12" & 16", No. 22 Heald rotary
16" & 24", No. 25A Heald rotary
12" Walker model DA vert. rotary
8" Pratt & Whitney rotary (tub)
6"x18", No. 2B Brown & Sharpe
8"x22", No. 78 Wilmarth & Morman
8"x22" No. 3 Abrasive
8"x24", No. 34 Abrasive vertical
14"x36" Pratt & Whitney vertical
14"x60" Mattison
24"x48" Springfield

CYLINDRICAL GRINDERS

4"x18" Landis type H
6"x18" Landis type C
6"x18" Norton, type C
6"x18" Brown & Sharpe No. 10
6"x20" No. 10 Brown & Sharpe mech.
6"x32", No. 11 Brown & Sharpe mech.
10"x18" Landis type C
10"x20", No. 1 Brown & Sharpe univ.
10"x24" Landis type C univ.
10"x24" Landis mechanical
10"x30" Norton mechanical
10"x36" Norton type C
10"x36" No. 2½ Bath univ.
10"x50" Norton mechanical
12"x30", No. 2 Brown & Sharpe univ.
14"x36" Landis type C
16"x72" Landis mechanical
23"x36" Norton type C

MISCELLANEOUS GRINDERS

No. 2 Cincinnati centerless
28", No. 226 Gardner disc
30", No. 86 Gardner horiz. disc
53", No. 372 Besly horiz. disc
15", No. 115 Gardner opposed disc
16", No. 214 Hanchett opposed disc
30", No. 230 Hanchett opposed disc
Nos. 00 & 1 Osterholm oscillating
No. 1 Lebiond tool & cutter
Nos. 1½ & 2 Cincinnati tool & cutter
No. 2 Norton tool & cutter
No. 2 ARC Oliver face mill
No. 3 Oakley tool & cutter
10"x72" Colonial broach grinder
No. 13 Brown & Sharpe univ.
No. R6 Keller radius tool
Oliver tool bit grinder
Model 4T Sellers tool bit
Gisholt tool bit grinders
18"x2½" Whitney wet grinders
Delta double carbide tool
No. 47 Excello carbide tool
No. 10C Sellers drill grinder
Nos. 6C & GP Sellers point thinners
Nos. 51 & 510 Oliver drill grinders
8" Standard Elec., pedestal
1 HP & 6 HP Hisey Wolf pedestal, D.C.
1 HP & 3 HP Mall flexible shaft
Nos. 33 & 35 Excello thread
No. 42 Van Norman radius
No. 10U Norton lapper
No. 2F Norton 30" hand lapper
30" No. 86 Gardner hand lapper
No. 2S Norton Hyprolap lapper
Model H1 Micromatic honer
No. 307 Barnesdrill honer

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GIDDINGS & LEWIS #257, 2½" Bar, latest
GIDDINGS & LEWIS #45, 3" Bar Table Type, latest
LUCAS #41, 3" bar, Table Type, Latest Type
NILES-BEMENT-POND 5", 5" bar, Floor type, M.D.
UNIVERSAL 3" bar, high speed, latest type
BORING MILLS—Vertical
BETTS 120", 2 swivel heads, AC, Motor Drive
BULLARD 8" 8 Spin. Mult-Au-Matic, Type J, latest
BULLARD 12" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 16" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 26", 36", 42" "Spiral Drive," Latest Type
BULARD 61" "Mult-Miller," 2 heads, Motor Drive
COLBURN 72", 2 Swivel Heads, PRT, Motor Drive
RING 62", 2 swivel heads, PRT, Motor Drive
NILES 100", 2 swivel heads, PRT, DC, Motor Drive
BRAKES—Power
CINCINNATI Series 300 ¼" x 8' 6", M.D.
VERSON #200, 16 gauge x 90", Latest Type
GEAR CUTTING EQUIPMENT
BROWN & SHARPE #13 Spur & Bevel Gear, M.D.
FELLOWS #61, #7, #7A, #7S, #75, #77, #Z, #6Z, High Speed Gear Shapers, latest type
GLEASON 3", 12" straight bevel generator, Latest
GOULD & EBERHARDT 12H, 12HS Hobber, Latest
GOULD & EBERHARDT 90H, Hobber,with diff.,m.d.
SYKES #1½, 18" Cap., Herringbone Gear, M.D.
GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #13 Univ. Cutter & Tool, Latest
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
LANDIS 6x12, Type H Plain Hyd., latest Type
NORTON 6x18", 10x12", 14x36", Type C, Plain, latest
NORTON 6"x30", 10"x36", type C, Pl. Hyd., latest
GRINDERS—Miscellaneous
BARBER COLMAN #5, 4, hob sharpener, latest type
BRYANT #16-CP-16, #24 Int. Hyd., latest type
CINCINNATI #2 Centerless "Filmatic," latest type
COVEL #22 Universal Tool & Cutter, Latest Type
HEALD 72A5, 72A5 "Gagematic," Internal, Latest
HEALD 75A, 72A3, 72A5, 74, 76A Internal, latest
LANDIS #12 Centerless, Hydraulic, Latest Type
GRINDERS—Surface
BLANCHARD #11, 16" chuck, Latest Type
HANCHETT Series 300, 12"x18" Vert. Sp. Hy. Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 23A—Rotary—16" and 30" chuck, hyd., latest
THOMPSON 12x12x24 Type B Hyd., Latest Type
LATHES—Engine & Mfg.
AMERICAN 36"x360" centers, 2 carriages, motor dr.
LEHMANN 16x30" centers, TIMKEN, latest type
LeBLOND 13x60, 1x84, 8x86, 8x104, 5x34, Latest Type
MEDART #6LSP Bar Turner, 1" to 6" Cap. Latest
MONARCH 10"x20" centers, Model EE Timken, latest
MONARCH 12"x30" Centers, 12"x54" Centers, Model CK, Timken Bearing, Latest Type
MONARCH 16"x78" centers, Timken, Model CW, latest
MONARCH 22"x156" centers, 3 carriage, Timken Bearing, Model CM, motor drive
NILES 30x50" Duplex, "Timesaver" Timken, Latest
PRATT & WHITNEY 14"x54" Centers, 16"x10" Centers, Model C Timken Bearing, Latest Type
SPRINGFIELD 16"x30" centers, Timken, latest type
LATHES—Turret
BARDONS & OLIVER #5, #7, Timken, Latest Type
FOSTER #4FU "Fastermatic" Timken, Latest Type
GISHOLT #1L, #2L, #3L, Universal, Timken, Latest
GISHOLT #1, #1, Multi Unit, TIMKEN, Latest Type
JONES & LAMSON #3, #5 Univ., Timken, Latest
LIBBEY "International" 1-H5, Univ., Timken, latest
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
WARNER & SWASEY #2, 3, Ram—Timken, latest
WARNER & SWASEY #2A Universal, Latest Type
WARNER & SWASEY 4A Universal, Timken, Bar and Chucking, (New 1947)
MILLING MACHINES—Plain
BROWN & SHARPE #2, Light Type, Timken, latest
BROWN & SHARPE 2B, 3B, Timken, Latest Type
CINCINNATI 08 Auto., rise and fall, latest type
CINCINNATI #4 TIMKEN, High Power, Motor Dr.
CINCINNATI 4-36, 2-18 Hydromatic, Simplex, latest
KEARNEY & TRECKER 121S, 140A, Latest type
KEARNEY & TRECKER 2H, 3H, 4H, Timken, latest
KEARNEY & TRECKER #3, 4, Hyv. Timken, M.D.
KEMPSMITH #3G, #4 Timken, High Speed, latest
MILLING MACHINES—Vertical
BROWN & SHARPE #2R Timken, High Speed.
CINCINNATI #2, Dial Type, Timken, latest type
GORTON #8½D, 9J, high speed, latest type
KEARNEY & TRECKER #3H Timken, latest type
REED PRENTICE 3VG, with duplicator, latest type
SCREW MACHINES—Automatic
CLEVELAND 9/16" model A, high speed, latest type
CONOMATIC 6", 4 spindle, High Speed, latest type
CONOMATIC ⅝"—6 spindle, High Speed, Latest
GOSS & DeLEEUW 6" auto. Chucker, 5 spin., latest
GOSS & DeLEEUW 6"x⅝" Auto. Chucker, Latest
SHEARS—Power
QUICKWORK ¾", 1" Cap. Rotary, Motor Drive
WYSONG & MILES #572, 14 gauge x 6' Latest Type
MISCELLANEOUS
BARNES #17Z, 20GH, 20Z, 20ZB Vertical Hone, Hydraulic Self Oiling, Latest Type
CINCINNATI Centerless Lapper, Model ED, Latest
CINCINNATI 1-36 Duplex Vert. Surface Broach, Double ram, Model FR, Hyd., Latest Type
FOSDICK Model 42 Jig Borer, latest type, (New 1947)
LAKE ERIE 500 ton Vertical Hydraulic Press, latest
MICHIGAN 17½ Universal Reliever Latest Type
PRATT & WHITNEY (KELLER) Type BL-2416 & Type G Copying, latest type, 2 & 3 Dimensional
PRATT & WHITNEY ¼Rx50 Rifler, Latest Type
PRATT & WHITNEY 6 x 60 Thread Miller, latest

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Brown & Sharpe #0G—⅜" Cap., Hi-Speed— 1¼" Max. Turning Length—155 to 4150 R.P.M.—Slotting attchmt—Tooling (very late).

National Acme #RA—9/16" Cap. 6 spdl— 289 to 2885 R.P.M. attcmts and quantity of tooling (late).

Potter & Johnston #5DEL Auto. Chucker— 30" Swing—16" Turret Slide travel—5 face turret (late).

Potter & Johnston #6DRE Auto. Chucker—34" Swing—18" Turret Slide Travel—5 face turret —Timk. Brg.—quantity of tooling.

LATHES

Bridgeford 36"x56'—15 speed Gr. Hd.—3.05 to 150 R.P.M., 38" Act. Swing—48' C. Dist.— Taper attchmt—mtsd. Carriage.

American 30"x25'—12 speed Gr. Hd., Med. Pattern, Hi-Duty—6 to 260 R.P.M., 34½" Act. Swing—18' C. Dist.

Bridgeford 36"x14'—9 Speed Gr. Hd. 7 to 108 R.P.M. 38½" Act. Swing—84" C. Dist.

BORING MILLS (Table Type)

Defiance #25A—3¼" Bar—12 to 1000 R.P.M. —#6 Taper—added Vert. & Cross Range (late).

Universal 4" Bar—"Triway"—8 to 200 R.P.M. #6 Taper—added Vert. Range (late).

Giddings & Lewis #0—3⅛" Bar M.D.—15 to 225 R.P.M.—#5 Morse.

BORING MILLS (Vertical)

Niles-Bement-Pond 62" M.D., Standard Pattern—2 Swivel Heads on Cross—Rapid Traverse. Bullard—24", 36" and 42" "Spiral Drive" type.

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TYPICAL MACHINES

No. 41 Lucas Horizontal Boring Machine
14' Niles Tool Works Boring Mill
42" Bullard Vertical Turret Lathe
No. 49 Heald Bore-Matic, Double End
No. 47A Heald Bore-Matic, Single End
No. 46B Heald Bore-Matic, Double End
6'-17" Column American Radial Drill
No. 2BL Natco Multiple Spindle Drill
No. 2 Avey 4-Spindle Drill
No. 2KH 6-Spindle Allen Drill
No. 3 Foote-Burt Sensitive Drill
No. 13 Brown & Sharpe Tool & Cutter Grinder
No. 7 Badger Double-End Disc Grinder
No. 214 Besly Double-End Disc Grinder
No. 16-16 Bryant Internal Grinder
No. 72A Heald Plain Internal Grinder
10"x18" Cincinnati Cylindrical Grinder, ER Model
10"x36" Cincinnati Cylindrical Grinder, EA Model
6"x18" Norton Type C Plain Cylindrical Grinder
6"x18" Norton Horizontal Spindle Surface Grinder
No. 10 Blanchard Rotary Surface Grinder
No. 11 Blanchard Rotary Surface Grinder
No. 16 Blanchard Rotary Surface Grinder—Late Design
No. 25A Heald Rotary Surface Grinder
No. 3 Brown & Sharpe Universal Grinder
No. 2 Cincinnati Centerless Grinder
18x72" Monarch Geared Head Lathe—Older Style
1H-18 Kearney & Trecker Manufacturing Mill
M24 Kearney & Trecker Manufacturing Mill
2HL Kearney & Trecker Horizontal Plain Mill
No. 3 Cincinnati Plain Horizontal Mill
No. 3 Van Norman Plain Horizontal Mill
No. 4 Cincinnati Dial Speed Plain Horizontal Mill
No. 5 Cincinnati High Power Plain Horizontal Mill
Bridgeport Vertical Mill
No. 2 Cincinnati Dial Type Vertical Mill
2K Kearney & Trecker Vertical Mill
3H Kearney & Trecker Vertical Mill
66"x48"x12' Cincinnati Double-Housing Planer
6R Denver Acme Ram Type Universal Turret Lathe
3-J Gorton Pantograph and Roll Attachment

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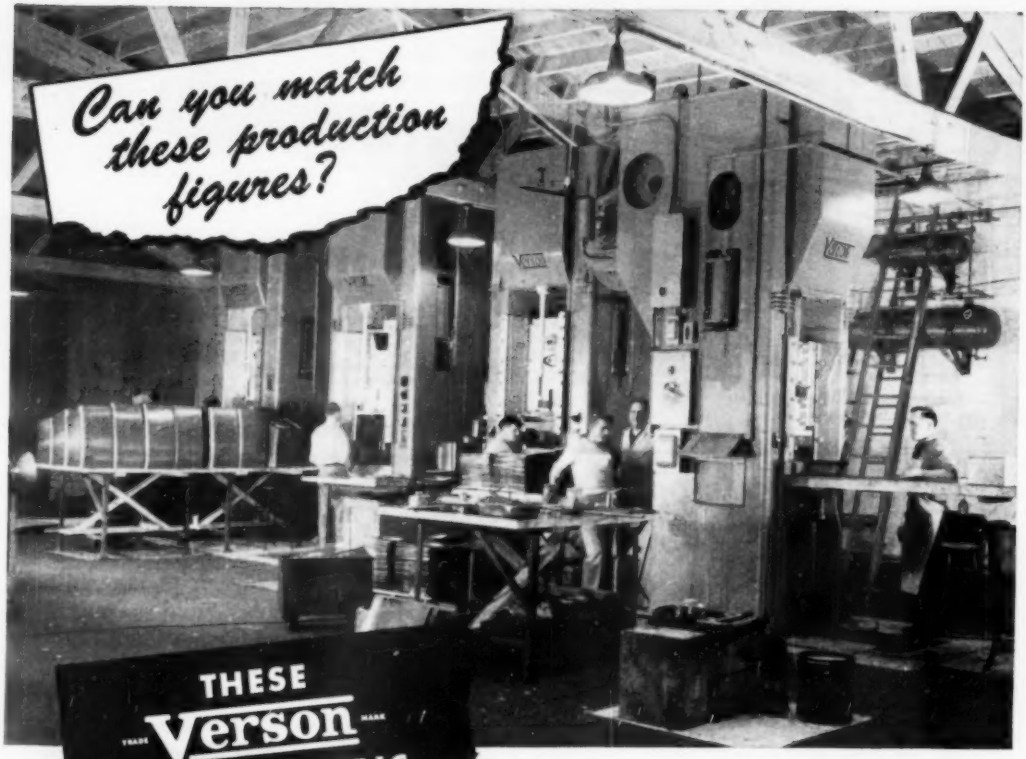
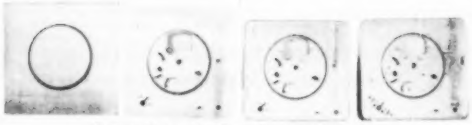
USED MACHINE DIVISION
1350 East 222nd Street • Euclid 23, Ohio


Can you match these production figures?
THESE
Verson
FULL ECCENTRIC PRESSES
Produce motor boards for automatic record players at the rate of 650 per hour!

The group of Verson Full Eccentric Presses illustrated above form a compact production unit that makes full use of Verson's advantages of speed, accuracy and power. Stock is automatically fed into the press at the extreme right where the first cut-off and drawing operation takes place. The pieces move on for trimming and piercing on the second press and forming in the third press. Final piercing is accomplished in the press at the extreme left. While set up for phonograph motor boards in this view, the presses can be changed over quickly for other jobs.

Get full details on how Verson Full Eccentric Presses can speed your production and lower your costs. And ask about such Verson features as: Allsteel Construction, Full Eccentric Action, "Straight Thrust" Eccentric Strap, Positive Action Clutch and Brake and others. Write today.



Stages in production of motor boards

First Operation: Cut-off and drawing | Second Operation: Trim and Pierce | Third Operation: Forming | Fourth Operation: Final Pierce

Originators and Pioneers of Allsteel Welded Stamping Press Construction

VERSON ALLSTEEL PRESS COMPANY

9316 South Kenwood Avenue, Chicago 19, Illinois — Holmes Street and Ledbetter Drive, Dallas 8, Texas

A VERSON PRESS FOR EVERY JOB FROM 60 TONS UP!

BLANKING PRESSES • FORGING PRESSES • DRAWING PRESSES • HYDRAULIC PRESSES
PRESS BRAKES • DIES • DIE CUSHIONS

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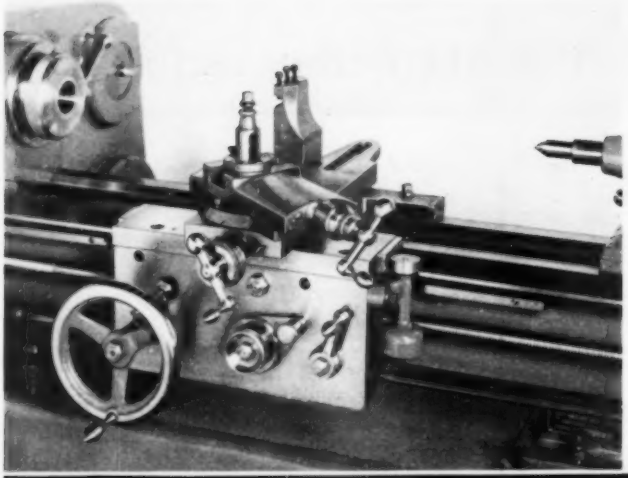


Wade NO. 8A equipped with REAR STATION TOOL BLOCK on the COMPOUND CROSS SLIDE

Here is a feature you'd never expect to find

on a lathe of this size . . . but we offer it
as one of the many unique advantages of the

Wade No. 8A TOOLMAKER'S PRECISION LATHE

This TOOL BLOCK, made of case hardened steel, is mounted on the rear station of the compound cross slide. It has a range of longitudinal adjustments, and will take cut-off or form tools. Naturally, it makes the No. 8A lathe more useful to you — eliminates the need of purchasing larger lathe equipment in order to have this very desirable feature.

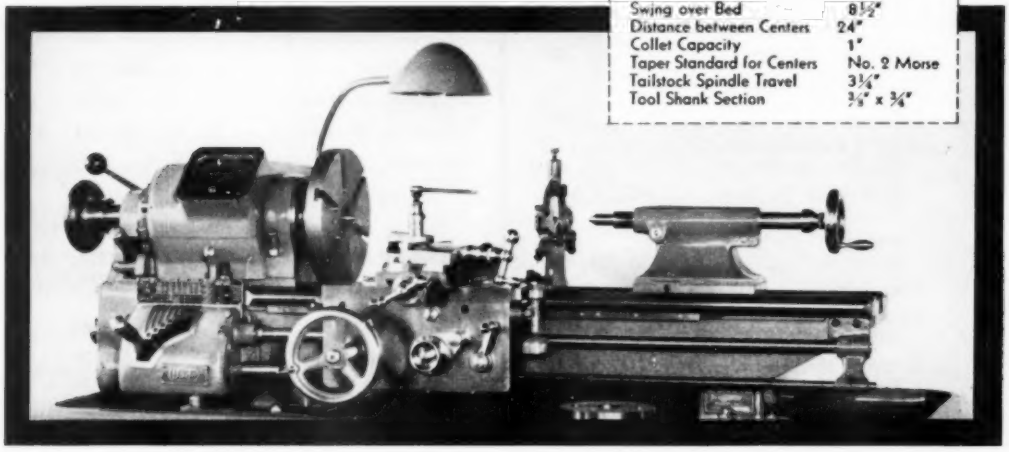
And what about speeds? This lathe gives you stepless spindle speeds from 32 to 2000 r.p.m. — the only lathe of this size and type offering such a range! (With the back gears engaged, stepless spindle speeds are from 32 to 220 r.p.m.) An electric tachometer registers all speeds. The variable speed drive is entirely mechanical and is designed for the spindle speed to be changed while the drive is running; however, no damage will occur if the operator should attempt to change the spindle speed when the motor is stopped.

OTHER IMPORTANT NEW FEATURES are fully described in our circular — better write today for a copy. Just say "Wade No. 8A Bulletin, please!"

THE WADE TOOL CO. 53 River St., Waltham 54, Mass.

SPECIFICATIONS

Swing over Bed	8½"
Distance between Centers	24"
Collet Capacity	1"
Taper Standard for Centers	No. 2 Morse
Tailstock Spindle Travel	3¼"
Tool Shank Section	⅜" x ¾"



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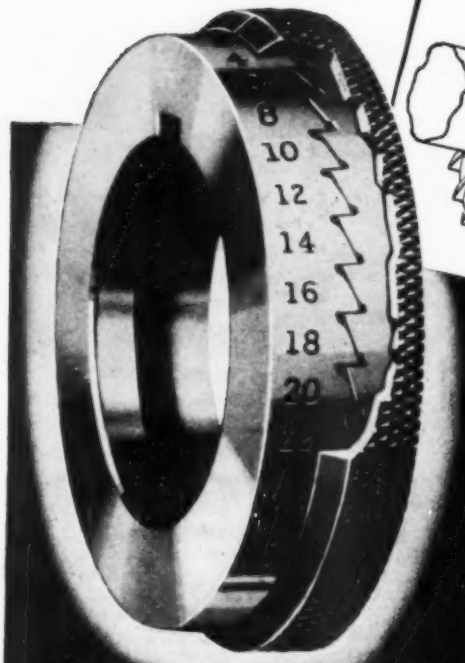
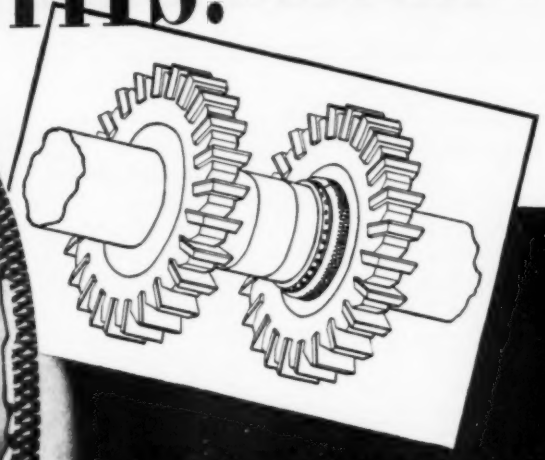
GIVE 'EM FITS!

Here's how to "fit" the exact spacing requirements between cutters, in straddle or gang milling and multiple slotting setups.





S. J. Adjustable Spacing Collars

—manufactured exclusively by Scully-Jones, can be adjusted to make a perfect "fit," to the exact decimal space needed between cutters, without removing cutters from arbor to mount shims.

These adjustable collars have an expansion of .002" per step and a maximum expansion of .024". The teeth have a three-point bearing, at all times assuring uniform parallelism of the sides. They are hardened and ground and each tooth is ground on the side and face.

Count the Cost—Compare the Accuracy

—of Solid Spacing Collars made in your own shop—and you'll choose

S. J. Solid Spacing Collars

These Collars are carefully heat treated,* and widths are ground parallel to .0005 plus or minus.

Prompt delivery can be made on the standard sizes of S. J. Solid Spacing Collars.

*Except sizes of less than ⅛" thick.

See pages 128 and 129 Scully-Jones Catalog No. 500 for Adjustable and Solid Spacing Collars.

Write us for further information.

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1902 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

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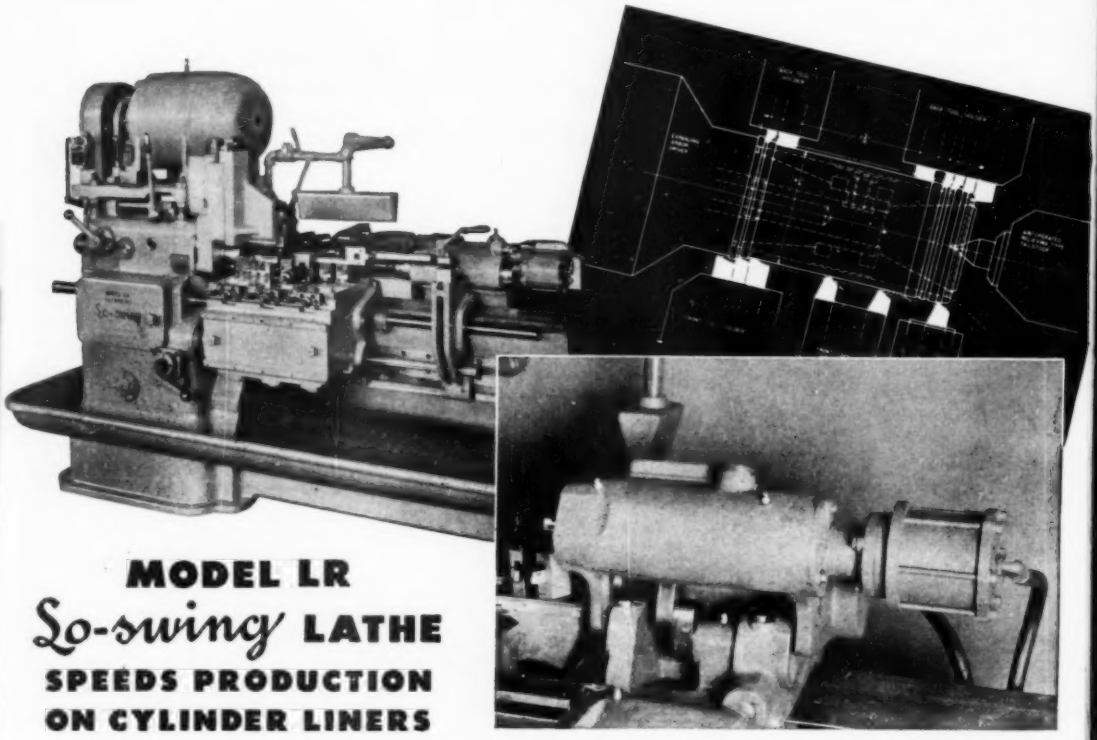
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



MODEL LR Lo-swing LATHE SPEEDS PRODUCTION ON CYLINDER LINERS

Problem: To automatically turn outside diameters, face and groove cast iron Cylinder Liners of various types with Carbide Tools.

Solution: Model LR Lo-swing Automatic Lathe was selected for this job because of its demonstrated fine performance with carbide tools, and its ease of setting-up due to its Simplified Change-Over Mechanism. A Relieving Tailstock which minimizes tailstock spindle overhang, and which facilitates loading and unloading, was incorporated.

The cast iron cylinder liners are delivered to the Lathe with the bore machined to size and the large end faced. They are held and driven with an air-operated, expanding collet arbor which extends the full length of the piece. This large area driving surface permits the high cutting speeds and coarse carriage feeds required for fast production. Loading of the parts is simplified with the Relieving Type Tailstock, shown in the close-up illustration. Since the driving arbor is bolted to the spindle nose, the operator is relieved of handling heavy stub arbors generally used when work is held between centers. The outside diameters and the short taper on the tailstock end of the liners are turned with six tools mounted on the front slides; all facing and grooving operations are accomplished with tools mounted on the rear slide. The entire operation is automatic—the operator simply loads and unloads the p··ts and pushes the starting button.

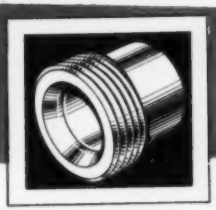
Seneca Falls engineers are at your disposal to assist you with your turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

In the customer's own words...

Here's how New Britains produced a better method



Part Machined – 3/4" Union Female End

	OLD METHOD	NEW METHOD
TYPE MACHINE & MODEL	[redacted] Hand Screw Machine	New Britain Model 656 Automatic Chucker
PRODUCTION PER 8 HR. DAY	375	1400
INCREASE IN PRODUCTION	—	400%
OVERHEAD	75% of cost per piece	50% of cost per piece

. . . we are now making the male end on the Model 656 too, and converting our New Britain Model 467 to second operation work. We also completely machine a union coupling nut on a specially adapted Model 675 New Britain with comparable savings. We are also interested in getting a quotation on a Model 88 New Britain Automatic.

CATAWISSA VALVE & FITTINGS CO.

C. L. Davis
Plant Engineer

THE JOB: Eleven operations are performed by a six spindle New Britain Automatic, in facing end, chamfering both sides of thread diameter, drilling through piece and finishing seat, turning thread diameter and threading O.D.

There's a *better method* to be found in every shop — dozens of them in most.

Find them and you have the surest way to keep your costs at competitive levels. The New Britain sales engineer in your area can help you with them. Why not give him a shot at some of the problem pieces you make? Write us direct for "IT CAN BE DONE" — cost histories on many actual pieces. It's packed with production ideas.

NEW BRITAIN
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT

549HG1

"More power, extra high accuracy with TIMKEN® bearings in the headstock"

—SAYS MANUFACTURER OF SEBASTIAN LATHES

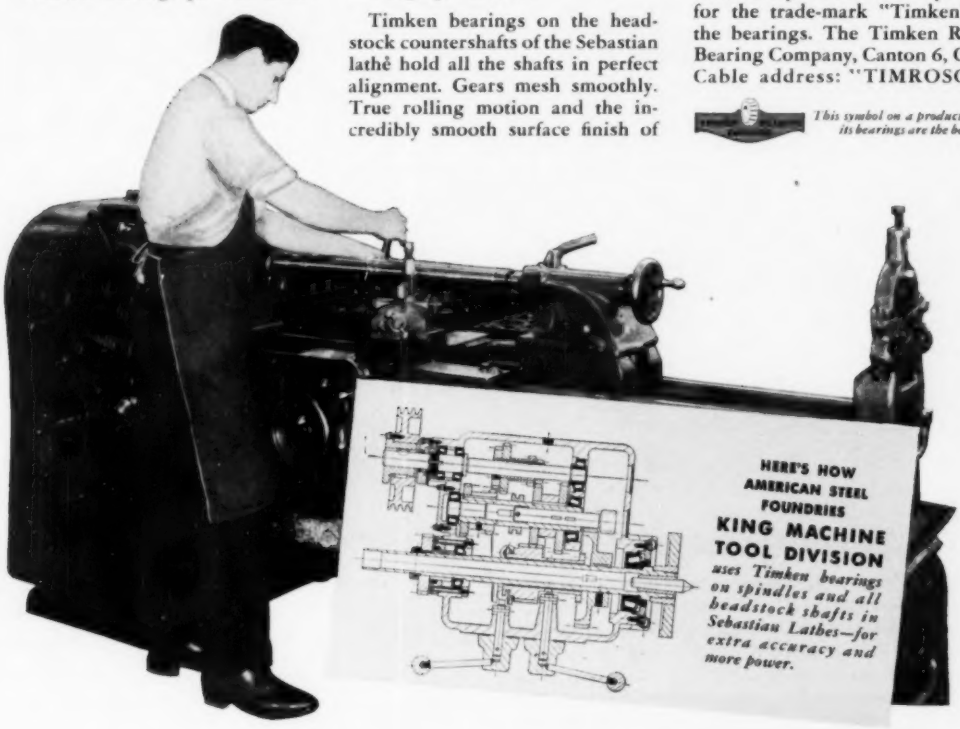
GREATER precision and much more power available for useful work! That's what King Machine Tool Division, American Steel Foundries, wanted in their Sebastian Lathes. And that's what they *got*—by using Timken® bearings not only on the spindle, but on all shafts throughout the headstock!

Timken bearings provide maximum precision by keeping the spindle rigid, yet free to revolve accurately. Their tapered construction carries both radial and thrust loads without deflection or end-movement and permits accurate pre-loading. Line contact between the rolls and races gives extra load carrying capacity for heavy cuts and high production.

Timken bearings on the headstock countershafts of the Sebastian lathe hold all the shafts in perfect alignment. Gears mesh smoothly. True rolling motion and the incredibly smooth surface finish of rolls and races practically eliminate friction. That means less power waste in the headstock—more power at the spindle nose.

The superiority of machine tools equipped with Timken bearings is recognized by users everywhere. For top performance, be sure you have Timken bearings in all the machines you build or buy. Look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



HERE'S HOW AMERICAN STEEL FOUNDRIES KING MACHINE TOOL DIVISION *uses Timken bearings on spindles and all headstock shafts in Sebastian Lathes—for extra accuracy and more power.*

NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

TIMKEN

TAPERED ROLLER BEARINGS

TIMKEN 1899 50 1949 YEARS

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION